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THE REVIVAL OF ALCHEMY.*

"Superfluous rehearsalls I lay asyde,
Intendyng only to give trew informatyon
Both of the theoryke and practicall
operatyon;
That by my wrytyng who so will
guyded be,
Of hys intente perfyctly speed thall he."
GEORGE RIPLEY (1471).

FRAUD, folly and failure have been deeply written into the annals of alchemy in all ages; it was early characterized as an 'art without art, beginning with deceit, continued by labor and ending in poverty,' and in modern times its extravagant pretensions have been condemned by an exact and critical science, yet notwithstanding there are to-day indications of a resuscitation of the captivating theories and of renewed attempts at their practical application, of great interest to students of the intellectual vagaries of mankind.

Belief in the possibilility of prolonging life by an artificial elixir and of transmuting base metals into silver and gold was generally entertained in the Middle Ages, not only by the ignorant masses, but even by serious-minded philosophers imbued with all the learning of the time; and the popular faith was sustained by the tricks of unprincipled impostors who found it profitable to prey upon the credulity and avarice of their fellow men. Those who in

* Read before the New York Section of the American Chemical Society, October 1, 1897.

modern times have written of alchemists find in the extravagant views of a Paracelsus, and in the careers of a Flamel, a Sendivogius, or of a John Dee, more entertaining materials than in the abstract conceptions of sober philosophers, and consequently most readers are more familiar with the misdeeds of adventurers than with the honest beliefs of respectable men of science. Before condemning those who labored day and night to solve the problems of transmutation and the elixir of life we should consider their intellectual environment; superstitious beliefs of every kind prevailed; even the sciences were in bondage; astronomy was dominated by astrology; medicine was influenced by magic; natural history was subject to blind belief in authorities, and scientific chemistry was entirely overwhelmed by the chimeras of alchemy. Kepler and Tycho Brahe, at the Court of Rudolph II., did not think it beneath their dignity to cast horoscopes for gain and to predict the future by consulting the positions of celestial bodies, even while formulating the laws governing their motions. European crowned heads retained astrologers and alchemists as members of their courts. A century later Sir Isaac Newton dabbled with furnaces and chemicals in true hermetic style; and Leibnitz showed the courage of his convictions by acting as Secretary of an Alchemical Society in Germany. The influence of superstition on the mental attitude of truly great men decreased with the advancement of learning, and when the foundations of scientific chemistry were laid by Priestley, Lavoisier, Scheele and their contemporaries, the doctrines of alchemy were abandoned. And yet not wholly abandoned, for there seems to have been a small number of persons in all countries who have clung to the hope of realizing transmutation, a hope sustained by the desire to reap the golden reward. This minority rejected the extravagant belief in a life-prolonging elixir, and in the divine origin of the profound secrets of the initiated, and sought to appropriate from the growing sciences such discoveries and theories as could be interpreted in favor of transmutation.

The printing press has never ceased to issue works devoted to the subject. Some authors have written of a 'higher chemistry,' and others have sought to reconcile the new doctrines of chemists with the ancient theories of alchemists. As recently as 1832 a German professor wrote a learned volume with the avowed intent of proving the verity of transmutation from historical sources (*Schmieder's Geschichte der Alchemie, Halle*, 1832). The number of reprints of the grotesque writings of reputed adepts which have appeared since chemistry has become an exact science is surprisingly large, and the fact that they find purchasers indicates a small but zealous class of hermetic students. So eminent a chemist as Sir Humphry Davy did not hesitate to affirm that some of the doctrines of alchemy are not unphilosophical.

Recent discoveries in physics, chemistry and psychology have given the disciples of Hermes renewed hopes, and the present position of chemical philosophy has given the fundamental doctrine of alchemy a substantial impetus; the favorite theory of a *prima materia*, or primary matter, the basis of all the elementary bodies, has received new support by the discoveries of allotropism of the elements, isomerism of organic compounds, the revelations of the spectroscope, the practical demonstrations by Norman Lockyer, the experiments on the specific heat of gaseous bodies at a high temperature by Mallard and Le Châtelier, the discoveries of Sir William Crookes as set forth in his monograph on 'Meta-elements,' the discovery by Carey Lea of several singular allotropic forms of silver, and, most

weighty of all, the mass of related facts and phenomena which find their ultimate expression in the Periodic Law of the Elements, so that many chemists of the present day are inclined to believe in the mutual convertibility of elements having similar chemical properties. Daniel Berthelot, in his notable work entitled 'De l' allotropie des corps simples,' boldly affirms his belief in the unity of matter. He says: "Without seeking to find in any one of the known elements the generator of the others, can we not invoke the facts that we have revealed in our study of carbon, in favor of the hypothesis of a unique matter unequally condensed?" And elsewhere he writes: "The transmutation of an element is nothing more than the transformation of the motions which determine the existence of said element, and which gives it special properties, into the specific motions peculiar to the existence of another element."

Simultaneously with the development of the truly scientific aspect of alchemical theory, there has arisen an extraordinary revival of the metaphysical side of the question; this goes hand in hand with the interest in chiromancy, astrology, theosophy and occult sciences which occupy so large a place in modern thought, literature and polite society on both sides of the Atlantic. This tendency to cultivate the esoteric manifests itself in the study of the Kabala, the investigation of the mysteries of Buddhism, Confucianism and other oriental philosophies, in researches into the phenomena of spiritualism so-called, and in the foundation of societies to study Psychic Force and the tenets of the followers of Madame Blavatsky; crystal-gazing, reading in magic mirrors, slate-writing, planchette, the quasi-scientific study of apparitions, of table-turnings, of rappings by unseen powers, of telepathy, of subliminal self, are now regarded as legitimate pursuits in no wise necessarily associated with the black arts of mediæval times, provided only they are conducted in a spirit of enquiry and for the purpose of discovering the latent power underlying these phenomena. And this line of research receives stimulus from the results secured by students of experimental psychology, of hypnotism, from such discoveries as the phenomena of the X-rays, and from the transcendental physicists who theorize on the miraculous consequences of four dimensional matter. Crowded lecture halls reward exhibitions of trance mediums, speakers on theosophy, palmistry and occultism; in lower walks of life fortune-tellers and clairvoyants reap a modest harvest; books treating of occult themes enjoy great notoriety; writers of fiction find it profitable to introduce the mysterious into the children of their brains; even secular journals, especially those of France, give space to the all-absorbing discussions on hermetism; these are some of the evidences of great popular interest in the unknowable. Only persons with special intellectual equipment are able to measure, weigh, sift and coordinate the novel phenomena gathered by researches in the field of hypnotism, psychology and occultism; those of weaker mental powers fail to perceive the real significance of the discoveries and are led away into unprofitable and dangerous superstitions.

In the Middle Ages alchemy was nurtured by ignorant superstition; now it is fostered by the prevalent devotion to esoteric studies; formerly the popular belief was in part supported by the fraudulent claims of impostors; now a higher standard of intelligence rejects the transparent tricks of imitators of Cagliostro. There are, indeed, occasional attempts to swindle the credulous by appeals to avarice; we read in the daily press of an American confidence-man who tried to cheat a London jeweler by pretending to 'multiply' sovereigns; of a

vulgar scheme of fraud among ignorant tradesmen on the east side of New York City, in which lead, iron scraps, crucibles and furnaces formed the properties; and of the larger operations of an educated French chemist who found dupes in both South and North America; but in each of these cases the severe logic of law courts intervened and abruptly discomfited the swindlers. It is not by sleight-of-hand that the revival of alchemy is now being engineered, but by a company of educated charlatans.

The movement to resuscitate alchemical doctrines and practices has been particularly successful in France, where there are to-day four societies and a 'university' claiming to possess occult knowledge of hermetic mysteries; these secret societies are named: 'Ordre de la Rose-Croix, 'L'Ordre Martiniste,' 'La Société d' Homéopathie Hermétique' and 'L' Association Alchimique de France.'

The first two of these societies seem to work on lines similar to Free Masonry, and claim that their secret mysteries were bequeathed by the last sages of Atlantis and by the Lemures to their brethren in Asia and Egypt, dwellers in sanctuaries whence issued Krishna, Zoroaster, Hermes, Moses, Pythagoras and Plato. The priestly Magi who preserved this lore in the temples of Thebes, Heracleopolis, Aphrodite, Pthah and Serapis were succeeded by secret alchemical societies of the first centuries of our era; then followed the Hermetic lodges of the Arabs, and these gave rise to the Templars, the Rosicrucians and the Martinists.

The third society cultivates especially occult therapeutics, a system of medicine invented in the sixties by Count Cæsar Mattei, of Bologna, which unites the principles of Hahnemann with those of the Iatro-chemists, disciples of Paracelsus. This new departure in medicine publishes four monthly organs and special treatises all its own.

The Alchemical Association of France is successor to the Société Hermétique, which was founded by the late Albert Poisson († 1894), also known by the pen-name *Philophotes*. Its seat is in Paris; the objects of the Association as set forth in its Constitution are "the theoretical and experimental study of evolution and of the transmutation of bodies. Its members, with this end in view, study the processes of the ancient alchemists and compare them with the work of modern chemists." These objects are to be accomplished as follows: "The Association proposes to assist in reviving the unitary doctrines of chemistry: 1st, by grouping the efforts of isolated workers by means of *L'Hyperchimie;* 2d, by furnishing them the aid of advanced students; 3d, by supplying so far as possible books and apparatus to its members. Researches of the members, when approved by the Masters, should be forwarded in duplicate to the Secretary-General; one will be printed in *L'Hyperchimie*, and the other will be preserved in the archives of the Association for the benefit of members who can secure it on demand." "Candidates for admission must pass an examination in: 1st, the theory and history of alchemy; and 2d, the elements of physics and of chemistry (without mathematics). A diploma from a normal, polytechnic or industrial school will be accepted in place of No. 2."

The affairs of the Association are controlled by the Secretary-General, F. Jollivet-Castelot (of Douai), assisted by seven Councillors, who hold an annual meeting. There are at present (July, 1897) two Honorary Members, Camille Flammarion, the popular writer on astronomy, and August Strindberg, a Swede residing in Austria, author of several hermetic essays.* There are two other classes of members,

* Dr. Stephen H. Emmens, of New York, has been added to the list of honorary members since writing the above.

masters (*maîtres*), who are chosen from the ordinary members by the Council after an examination of their writings; and ordinary members (*membres adhérents*), of which the number is unlimited. Modest dues entitle the members to the organ of the Association, *L'Hyperchimie*, a monthly review of alchemy and hermetism founded in 1896.

The Councillors of the Alchemical Association have combined with the active members of the other Societies named to establish a *Université Libre des Hautes Études*. At present this includes three Faculties:

I. Faculté des Sciences Hermétiques, of which the Association Alchimique forms a section. The director of this Faculty is Dr. G. Encausse, and the course of instruction embraces the study of the *Tarot*, alchemical philosophy and practice, occultism, mysticism, Hebrew, etc.; the curriculum leading to the 'baccalauréat-en-Kabbale' is under the supervision of the Group of Esoteric Students, while candidates for the degrees of master and doctor are under the direction of the Martinist Order.

II. Faculté des Sciences Magnétiques, represented by the École de Magnétisme de Paris, and under the direction of M. Durville; it has branches at Lyons, Bordeaux and other cities.

III. Faculté Spirite, comprising several sections of Spiritism.

Each Faculty preserves complete independence, being 'united only by moral bonds destined to hasten expansion of the rational spiritualistic movement.'

The nature of the instruction given at this University will appear in the review of the philosophy of its promoters.

The leading spirits in these secret societies and in this University are as follows: F. Jollivet-Castelot, Secretary-General of the Alchemical Association, special delegate to the Supreme Council of the Martinists, editor of *L'Hyperchimie*, and author of 'Comment on devient Alchimiste,' 'L'Hylozoisme' and other alchemic treatises; Dr. M. H. E. Lalande, whose pen-name is *Marc Haven*; F. Ch. Barlet, author of 'Essai sur l'Evolution de l'Idée;' Dr. G. Encausse, who generally conceals his identity under the signature *Papus*, is President of the Esoteric Group,* President of the Supreme Council of the Martinists and the author of sixteen treatises on hermetism and magic, among which may be named 'Traité élémentaire de Magie Pratique.' Papus is also editor of *L'Initiation*, a journal devoted to theosophy, magic and occultism, and of *Le Voile d'Isis* a weekly review of spiritualism. Stanislas de Guaita is best known as the author of 'Le Temple de Satan,' 'Clef de la Magie Noire,' and 'Le Probleme du Mal,' works dealing with sorcery, the astral light in man and other mysteries. Marius Decrespe's essay on 'Les Microbes de l'Astral,' Paul Sédir's 'Les Incantations' and Albert de Rocha's 'Exteriorisation de la Motricité' are works which indicate the mental attitude of those engaged in the revival of alchemy and hermetism. A bibliography of this class of works is here out of place; a single trade catalogue enumerates one hundred and twenty titles, chiefly of recent date.

One of the oldest workers in the Alchemical Association is the 'Master' Théodore Tiffereau; in 1854–55 he sent to the French Academy of Sciences six memoirs in which he claimed to have discovered a method of converting silver into gold. Tiffereau had made his experiments in Mexico at great expense, supporting himself meanwhile by taking daguerreotypes. His process was repeated at the Mint in Paris before the as-

* The Groupe Indépendant d'Études Ésotériques has 1,600 members, 104 branches and correspondents. It embraces members of the following societies: Ordre Martiniste, Ordre Kabbalistique de la Rose-Croix, Église Gnostique, Société Alchimique de France. Membership is free.

sayer, M. Levol, but with little success. The substance of his memoirs was published in 1855 in a volume entitled 'Les Métaux sont des Corps Composés;' of this a new edition was published by Lermina in 1889. Tiffereau has never abandoned his claim, and as recently as October, 1896, he addressed another memoir to the Academy, in which he attempts to prove that the metal aluminum is a compound. Briefly stated his process is as follows: He placed in a stout glass tube a piece of aluminum foil with pure nitric acid and sealed the tube hermetically. He then exposed the tube and contents to the sun's rays during two months; at the end of this time he opened the tube; it gave out an odor which he thought was due to ether, and it yielded a few grammes of crystals which he thought tasted like acetic acid. Since both ether and acetic acid are compounds of carbon, Tiffereau concluded that this element was derived from the aluminum. Analytical chemists would criticize this experiment in several points; they would say Tiffereau did not demonstrate the absence of carbon in the metal used, and that he depended upon smell and taste for proofs of the carbon compounds; the tongue and the nose are incontestably useful adjuncts to the reagents of a chemical laboratory, but additional tests for ether and acetic acid would have been more conclusive. In Tiffereau's recent writings he attributes the transmutation of a base metal into the most precious one, to the action of the 'microbe of gold.'

For a student of chemistry to read, digest and write down in intelligible language, in a limited space, the principles of this new school of chemical philosophers is a difficult task, even for one somewhat familiar with the literature of the ancient alchemists; consequently the following analysis falls far short of the ideal. It is properly the work of a kabalist, a theosophist and a magician, proud designations which the writer disclaims. The modern alchemists accept all the traditions of their ancient predecessors, but give them a new significance, and interweave the novel phenomena derived from researches in pure science. They claim that during the fourteenth, fifteenth and sixteenth centuries the official schools of instruction taught exclusively the physical part of the sciences, and that the metaphysical part (which is the real life and soul of the study) has been rejected under the opprobrious name of occult science. This living aspect of science has, however, been studied in the secret societies of the initiated, which have preserved the traditions of the kabala, the mysteries of hermetism and the practice of transmutation. The study of science is as much a religious question as an intellectual one, and worship at an altar should sustain and enlighten the worker in a laboratory. 'Chemistry, alchemy and hermetic philosophy form three steps of the ladder which leads the initiated from the laboratory, through artistic realization, to the oratory: '*Labora, Opera, Ora et Invenies.*'"

The modern alchemists also maintain that Darwin and his disciples appreciated but a small part of the great doctrine of evolution, which should be applied to the chemical elements as well as to living beings. The starting point in the evolution of elements is the ether (the universal astral fluid of the kabalists), the infinitely divisible particles of which form chemical atoms by agglomeration. This ether is condensed energy, and hence all matter is resolved into energy.

Energy, matter and motion form a trinity analogous to the Divine Trinity, one in substance, three in appearance. Matter is one in kind, and the diversity of chemical bodies results from differences in grouping and in motions of the constituent particles. Intelligence is allied in a mysterious way

with matter and energy, forming another trinity. Every atom centralizes intelligence, is in itself a living entity and by a process of self-evolution yields the diverse natural bodies. "Ether is the father of hydrogen, from which are derived oxygen, nitrogen, carbon, etc., combinations due to etheric vortices." "Perhaps helium should precede hydrogen." This view of matter as a living entity is greatly insisted on, and the doctrine is called *Hylozoism*. An alchemist who expects to succeed must possess psychic power over the atoms, so that by the action of his will they shall group themselves to form the metal desired.

Such is the physical philosophy of modern alchemists; the kabalistic philosophy is by no means so clear, being closely linked to the *Tarot*, which signifies the 'hieroglyphs and algebraic calculations of the Primordial Genesis.'

Students of the mystical philosophy of the Hebrews discover profound occult significance in accidental similarities of widely differing objects and phenomena. The seven planets, seven days of the week, seven colors, seven orifices in the head, seven metals known to the ancients, seven archangels and seven infernal demons present to the truly kabalistic mind marvellous and precious analogies. In the 'Table of Concordance of Major Arcana' these correspondences are given: 'Heth–Justice–Elementary existence–Nizah–Cancer–June–Hydrogen–Fire.'

Jollivet-Castelot has written of Kabalistic Alchemy, and a perusal of his essays leaves in the mind of the uninitiated confused memories of colors, numbers, signs of the zodiac, alchemical operations as distillation, fixation and the like, the names of the sons of Jacob, certain precious stones, geometrical figures, Hebrew characters, Azoth, quintessence and the Devil, all discussed in a language as obscure as the symbolism portrayed. To conceal esoteric mysteries abbreviations are often used, but one does not have to be very deeply initiated to recognize in P.·. Ph.·.'pierre philosophale,' and in G.·. O.·.'grand oeuvre.'

Astral light is an important factor in modern hermetism, and is related very closely to the 'radiant matter' of chemists and the 'ether' of physicists. "Astral light is the universal agent, the universal plastic mediator, the common receptacle of vibrations of motion and of the phantoms of form." It is also the Od of the Hebrews and of Baron von Reichenbach; it is the great Thelesma of Hermes Trismegistus, and the control of this force constitutes the great arcana of practical magic. It heats, illuminates, magnetizes, attracts, repels, vivifies, destroys, coagulates, separates, crushes and gathers all things under the stimulus of powerful wills; it is a perpetual and transformable vibration. Its kabalistic figure, represented by the Serpent of Theogonies, is:

$$\text{Od} = +$$
$$\text{Ob} = -$$
$$\text{Aour} = \infty$$

When the universal light magnetizes the universe it is called astral light; when it forms metals it is called *Azoth*, or the Mercury of the Sages; when it gives light to animals it is called animal magnetism. The astral undulations determine the position of the atoms or neutralize them. Herein lies the secret of transmutation, and it becomes the privilege of the hermetist to acquire the power of controlling this agent.

The adepts in this phase of hermetism still appeal to the *Tabula Smaragdina* of Hermes Trismegistus as the embodiment of alchemic lore. The 'Father of Alchemy,' who has been identified with Canaan, Noah's grandson, invented arithmetic, geometry, astronomy and music, taught writing to the Egyptians, and gave laws and religious rites to the people; he was

perfectly acquainted with the 'philosophers' stone,' and, desirous that posterity should inherit the wonderful secret, he had the whole art of creating gold engraved on an emerald tablet, which was placed in his sepulchre. Many years later this was removed by Sarah, Abraham's wife, and she concealed it in a cave near Hebron; there it remained until again discovered by Alexander the Great. The inscription reads in part as follows:

"I speak not of fictitious things, but of that which is most true and certain. Whatsoever is below is like that which is above, and that which is above is like that which is below, to accomplish the miracles of one thing. Also since all things were made from one by the help of one, so all things are made from one thing by conjunction. The Father thereof is the Sun and the Mother thereof is the Moon; the wind carries it in his belly, and the nurse thereof is the earth. * * * This thing has more fortitude than fortitude itself, because it will overcome every subtile thing and penetrate every solid thing. By it this world was formed. Hence proceed wonderful things which in this wise were established. For this reason I am called Hermes Trismegistus, because I possess three parts of the philosophy of the whole world. What I had to say about the work of the sun is completed."

Writers on modern alchemy discuss the marvels of palingenesis, of homunculi, and of gamahes; they write of the materialization of a metal through the medium (mediumnité) of a metal; they cite the 'Rules of Philalethes,' the works of George Ripley and of the Cosmopolite, and refer in the same essay to Berzelius, Berthelot and Moissan. We are told that "*le diable est le singe de Dieu*," and that the "Cherubim of the Ark of the Covenant symbolizes the male and the female of the Universe, the Alchemical Father and Mother," by the very authors who show acquaintance with the most recent advances in pure chemistry. In liquid fluorin they perceive a realization of the Alkahest, or universal solvent long sought by mediæval alchemists.

Accustomed to juggle with numbers, the kabalist finds abundant opportunity in the atomic weights of the elements, and he makes the most of his opportunity. When the arithmetical sum of the atomic weights of elements entering into a given compound chances to equal the atomic weight of gold, this accidental correspondence is seized upon as a pretext for claiming hermetic relationship between the two substances.

August Strindberg has devoted much study to such correspondence and points out the following:

$$K_2MnO_4 = 197 = Au$$
$$Cu_2Cl_2 = 196 = Au$$
$$Fe_3S = 197 = Au$$
$$C_2H_5I + \tfrac{1}{2}\,Br = 197 = Au$$

He uses both 196 and 197 as the atomic weight of gold to suit his purposes, and seems to be very weak in arithmetic, for the hypothetical body Fe_3S has a molecular weight of 200.

The ammonium-ferrous-sulfate crystallized with six molecules of water, which chances to have a molecular weight equal to that of gold, is used by Strindberg as basis of the following experiment, which serves to show his method of reasoning and of operating.

Ammoniacal sulfate of iron = 392 = Au is perhaps the solution of the enigma; sulfate of iron (green copperas), precipitates solutions of gold; to precipitate according to monist-chemistry is to enter as a factor into the reconstitution of the body of a compound. Soak a strip of paper in a solution of sulfate of iron, and expose to the fumes of ammonia; the paper will assume a bluish-green color like that of the protoxid of gold. Dry the strip of paper over

a lighted cigar and the paper will acquire a chestnut-brown color like that of the deutoxid of gold. Little by little metallic flakes of a golden yellow color appear, forming a non-solid (*non-fixé*) gold, when the sulfate of iron produces an auto-fecondation by self-precipitation. However, the golden flakes amalgamate with mercury, which property is not shared by iron. After showing by appropriate tests that iron is still present the hermetic chemist proceeds to explain the reaction by assuming the formation of the hypothetical $Fe_2S = 196 = Au$, or of the imaginary compound

$$Fe_2O_3 + 2H_2O = 196 = Au,$$

or of the

ferrous-ammonium-sulfate = 392 = Au_2;

and he adds, 'The chlorid of gold is reduced by the nicotine of the cigar.' Since, however, no reagent containing chlorin in any form was used in the experiment, this element must have been created at the same time with the gold, which, however, is 'incomplete' gold soluble in unmixed acids.

A preacher should never be judged by a single sermon, and to do justice to these nineteenth century alchemists, one more 'recipe for gold' may be transcribed. "Put into a crucible layers of sheet iron and of powdered vitriol; place over it another crucible pierced with a hole for respiration. Heat in an intense fire. But a flux must be added to the crucible to prevent melting, viz: One kilo litharge, one kilo clean white sand, mix and add to the crucible at a red heat. Remove with an iron spoon the yellow oil and put it aside. The two compounds have not lost weight. This oil is dry water, a fire, a salamander. * * * You obtain a metal of a golden yellow, having a density of 24, not capable of being minted. This is changed into ordinary gold." With the exception of a few unimportant sentences, this is the entire recipe, but how the final transformation is to be effected is not given.

To acquire knowledge and power for successful hermetic labors, to become eligible for initiation in the occult societies, is no easy task. The aspirant must strive valiantly against the passions that assail him, casting out of his soul pride, anger, jealousy, hatred, avarice, hypocrisy, idleness. If the candidate for honors desires to become worthy of the name hermetic philosopher he must prove himself a Magian; he must learn to exercise his will on matter in all its forms, and to acquire this power he should practice crystal-gazing and reading in magic mirrors; to learn to perceive the invisible he must withdraw from the visible, imposing on himself psychic sleep, called by some hypnosis. As adjuncts to the attainment of the ideal mental state he should use perfumes, music and light; and eventually the astral body, separated from the physical body, will supply the intellectual, moral and material illumination indispensable to the Great Work.

It is rather discouraging to learn that, even after fulfilling all these hard conditions, no one can realize the perfection desired until he has passed through several of our planetary existences. The would-be alchemist must also follow the percepts of Albertus Magnus; he should be discreet, silent, and must not reveal the result of his labors; he must reside in an isolated place and choose the time and the hours for his tasks; he must be patient, assiduous and persevering, and he must be rich enough to bear the expenses of his pursuit. Besides ordinary chemical apparatus he should provide several objects indispensable to his work, a magic wand, a sword to dissolve the astral coagulations, a magic mirror, a brazier for perfumes, a wooden altar covered with a white cloth, and an alchemist's robe of white linen to be worn with a girdle

embroidered in gold and silver. In all his chemical operations he must project psychic force into the reagents.

Bright prospects for the future of chemical science are claimed by this school of philosophers. Inorganic chemistry is destined to follow the lines in which inorganic chemistry has prospered; the formation, derivation, or rather the evolution of metalloids (so-called) and of metals will be realized through etheric cyclones, different degrees of condensation of hydrogen. Chemical bodies are of one kind only and they are all organic and living.

There is a growing belief among advanced chemists in the theory that the elementary bodies as known to us are compounds of a unique primary matter (*protyle*), and that transformation of one kind into a similar one is not beyond the bounds of possibility, but we do not think that the modern hermetists are pursuing the right path to accomplish this end; nor do we believe that the world of science is any nearer the coveted goal of alchemical avarice.

The revival of alchemical pursuits in France finds concurrent sympathy in other parts of the world. Especially does this pseudo-art flourish in India, where the Sannyassis, a caste initiated in occultism, practice the transmutation of tin, zinc, copper and mercury into silver, or at least into a metal resembling silver superficially. In the published recipes for effecting this change arsenic plays a prominent part, a substance used for the same deception by the alchemists of the Middle Ages. In China a belief in alchemy has existed from very early times; reprints of ancient treatises are still for sale, and the experimental phase is quietly studied by semi-educated persons.

In the United States two notable events have occurred within twelve months, one of which seems to threaten financial revolution. A bold claim to manufacture gold of pure antimony has been made by Edward C. Brice, of Chicago; having been refused a patent on his process by the United States Patent Office, he demanded a test to be made, and three assayers of the United States Mint conducted the trial under Brice's instructions. Needless to say, the experiment did not verify the claim; the assayers found that all commercial antimony contains a trace of gold, and that Brice did not even recover the whole of this by his process. Brice's previous record does not bear the full light of investigation, so that this attempt to revive alchemical practice is on a par with many that have preceded it.

Quite different seems to be the equally bold claim of Dr. Stephen H. Emmens, that he has discovered a body intermediate between silver and gold and capable of being changed into gold; this substance he has named *argentaurum*. Dr. Emmens, who is an Englishman by birth, is the author of many books on a great variety of topics; a treatise on logic, another on explosives, several novels and many papers on chemistry, electricity and metallurgy as well as some poems show his versatility. He is a member of several learned societies, and inventor of the high explosive 'emmensite.' Dr. Emmens has established a laboratory for the manufacture of gold from silver by a secret process in which mechanical treatment plays an important part. Since April 13, 1897, he has sold to the United States Assay Office six ingots of an alloy of silver and gold for the gross sum of $954, as proofs of his success in transmutation. This matter having been exploited in the daily press, details need not here be reproduced.

In the United States, where education is so general and a shrewd, calculating, 'Yankee' spirit looks askance at such enticements, alchemy is not likely to flourish; on the other hand, hermetism, the meta-

physical phase of the philosophy seems far more likely to be cultivated by the devotees of theosophy and esoteric studies.

In conclusion, a passage from Lord Bacon: "I was ever of opinion that the philosopher's stone and an holy war were but the rendezvous of cracked brains that wore their feather in their heads."

H. CARRINGTON BOLTON.

WASHINGTON, D. C.

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*SCIENCE IN EDUCATION.**

DURING the year 1895–96 there were in attendance at the colleges and universities of the United States nearly fifty thousand students who were pursuing courses leading to the degree of Bachelor of Arts, and of whom nearly ten thousand received that degree. In the various technological and professional schools there were sixty-six thousand students and nearly or quite fifteen thousand graduates. That is, those students seeking the so-called liberal education were less than forty per cent. of all the candidates for college degrees.

In none of the professional schools, with but few exceptions, is the possession of a college or university degree necessary for admission. A single medical school at the present time requires its matriculates to possess the bachelor degree, and some others will in the near future. In the theological schools a preparatory college education is more usual, but the whole number of theological students in the United States is relatively small, and does not seem to be rapidly increasing.

Nearly one-half of the professional students are those studying medicine, and of these I do not think more than five per cent. are graduates of other courses. Less than that percentage will be found among the engineering students, for reasons that will appear later. The profession of law, which is yet far behind the other professions in its educational requirements, has less than ten thousand students in attendance upon college instruction in our country, not one-third of the number of the medical students, though the members of the two professions in practice are much more nearly equal in numbers. A much larger proportion of arts graduates turn to the legal profession than to any other, in part due to the fact that the educational requirements of the legal profession are, in general, on so low a plane that the earnest young man is not content to enter upon his life's work with so slight a college preparation as it demands; in part because the ordinary college course offers better preparatory training for the legal profession than it does for any other, save the theological or pedagogic.

I am not aware of any statistics of the number of arts graduates among the active members of the professions in America, as a whole, but the number is clearly very small, certainly not one in ten, and I believe that there can be no question but that the percentage is steadily becoming less from year to year.

Our first impressions are that this fact is to be deplored. I believe, however, that it is rather matter of congratulation, inasmuch as it certainly means in the end better preparation for the active duties of life by the great body of professional men.

In no branch of education has there been more active progress than in that of medical education in the United States during the past fifteen years, and in none has there been a larger proportional increase of students. Twenty years ago, with almost no educational requirements for matriculation, nearly every medical institution in this country would graduate the average student after two courses of lectures, the second a repetition of the first, and each of but four or five months' duration. I have known students of average ability to re-

*A presidential address before the thirtieth annual meeting of the Kansas Academy of Science.

ceive the diplomas of some of the most renowned medical colleges of the United States whose entire medical tutelage was comprised within a period of less than one year's extent.

At the present time many require four years of college work, or shortly will, and these college years are often eight or nine months in length and are never less than six. Furthermore, they are not mere repetitions, but are graded from entrance to graduation with constant laboratory practice and frequent examinations. When the course was of but two years' duration more students relatively sought preparation in a more liberal education in the college of arts, for the same reason that seems to actuate many law students. Many of the law schools now require but two years' attendance upon college work and practically only nominal preparation for admission, and the majority of the practicing lawyers of our country have had no college professional training at all. The better colleges are now extending their course to three years, and it is only a question of a short time when the period of college study necessary for the reception of the legal diploma will be equivalent to that of the medical profession.

The modern educational requirements of the medical profession have, I believe, raised it to a distinctly higher plane than that of the law. To use the words of Justice Brewer: "A growing multitude is crowding in who are not fit to be lawyers; who disgrace the profession after they are in it; who in the scramble after a livelihood are debasing the noblest of professions into the meanest of avocations; who, instead of being leaders and being looked up to for advice, are despised as the hangers-on of police courts and the nibblers after crumbs which a dog ought to be ashamed to touch."

But this condition will not last long. The time will soon come when everyone who appears before the bar of justice as an advocate will be a thoroughly educated man or woman. And does this mean that he will be required to have a four years' education in the college of liberal arts? Most certainly not. A four years' course in the law school will be required, whose certificate will carry with it the educational right to admission to the bar, and little or no attention will be paid to the so-called branches of liberal culture.

Conditions have changed much. The greatly increased competition and the greater struggle for existence now render it imperative that the professional man should be better grounded in the principles of his profession than he once was. The great accumulation of scientific knowledge has left the teas, the simples and the boluses for the quack in medicine. The lawyer can not be a politician, a real estate or insurance agent, and, in the intervals of his avocations, do justice to his client. The professional man can not spend much time in purely cultural and æsthetic studies, while his competitors are spending theirs in acquiring a knowledge of how to treat their patients or how to execute a legal document.

The average course in the college of liberal arts does not prepare for the studies of the medical profession, and not many physicians now urge young men to pursue the course in arts as a preliminary to professional training. A part of that time certainly is better spent in the more thorough mastery of the professional education.

The average age of graduation from the college or university at the present time is nearly twenty-three. The ambitious graduate in medicine will desire to give at least one year to hospital practice, or to travel before beginning his more active duties. He is then twenty-eight years of age, and two or three years more will certainly be needed

before he becomes an independent member of society.

And this is not the worst of it. In the profession of medicine, as in all other professions, book-lore or professional lore is only a part of the foundation for successful practice. A knowledge of mankind, of men and women, is more essential than a finished knowledge of his profession. At twenty-seven or twenty-eight a man is too old to acquire this knowledge in the best way; the plasticity of youth is waning, and new habits are hard to form. He must remain more or less controlled by his student habits, out of intimate touch with the great mass of the people and their inner life. And this lack of knowledge of human nature must surely remain as an obstacle to the most useful and successful practice.

President Eliot has said: "The average age of admission to Harvard College at this moment is fully nineteen. The student who stays here four years is twenty-three years old when he graduates. He then goes to our medical school to stay four years; so he is twenty-seven years of age before he has his medical degree, and we all know that some years intervene between that achievement and the competency to support a family. Now, that highly educated young man ought to have married at twenty-five."

The same conditions will surely confront the lawyer before long, and not only the lawyer, but the dentist, the theologian and students of other learned professions.

An answer that is brought as a solution for this unsatisfactory state of affairs is that the fault is in the preparatory schools. That poor teachers and poor teaching make the work of preparation for the college longer than need be, is very true, but I do not think that any relief obtained here will influence students toward the college of liberal arts. As teaching in the secondary schools become better and more efficient, other subjects will be crowded into the high school course, filling in all the time that is saved. This will be of added advantage to the professional student and will more and more tend to lead him away from the college of liberal arts. Furthermore, none of the colleges of the United States have shown much, if any, tendency to shorten the course leading to, or render less difficult the requirements for, the Bachelor of Arts degree.

The entrance requirements for the medical and law schools are at the present time very unsatisfactory. The medical schools have labored unceasingly to increase them for the medical degree, during the past ten years, so far as professional knowledge is concerned, but they have done very little towards increasing the requirements for admission to the schools. In very few schools are they at all equivalent to those for admission to the freshman class in the better colleges of liberal arts. A very little knowledge of some foreign language, usually Latin is required; a little mathematics and a little physics, and a passable knowledge of English; but the student needs very little of what the world calls liberal culture, and practically nothing whatever is demanded.

After considering these chaotic entrance conditions to the professional colleges of law and medicine, it is refreshing to turn to another, in which, with but little pretension, with modesty and deprecation, rather, a model has been set which all the other professions will, in the end, surely follow.

The engineering profession to-day is, upon the whole, the best educated in America. While there may be a smaller proportion of highly trained men, there is also a far smaller proportion of poorly trained ones than in either medicine or law. It may seem strange that that profession which comes less into immediate contact with the general public should be, upon the whole, more highly trained than

those which touch so closely the pecuniary and physical well-being of every one. But the reason is not hard to find. The engineer is judged more by his peers, while the lawyer's or physician's success is dependent very largely upon the public. The capacity of the engineer must invariably be made apparent to men of affairs and ability, while the lawyer or physician is judged, for the most part, by those who are incompetent to determine his real merits.

Undoubtedly, as the years go by, more rigorous requirements will be demanded from the engineer, as from the lawyer and physician, but I do not believe that they will ever be very great in extent, save as new methods of teaching are developed, and these will require ability and capacity rather than time. The engineer may enter upon active life at the age of twenty-four or -five at the outside, fully grounded in the principles of his profession. No gap is left in his education between the high school and his strictly professional course, but the one grades into the other in an harmonious way. Though he graduates with the commonplace degree of Bachelor of Science, it represents, on the average, more college work than does that of Doctor of Medicine.

If, then, the learned professions are drifting away more and more from the college of liberal arts, what is the object of a general college education? What does the average young man or young woman have in view when he enters upon a four years' course leading to the degree of Bachelor of Arts? Undoubtedly the larger number have nothing definite in view. They are actuated, for the most part, by the desire for a better education, without any clear idea of what they wish to accomplish in life. Had the student in the high school a definite conception of his future work in life he would be more apt to seek that special training which would most enhance his prospects for success. Many of the universities and colleges have endeavored to attract those students who have determined upon their life work, and who would otherwise skip the general college course, by offering some choice of studies, or by permitting the last year in the course for the arts degree to be spent in the professional school. This system of optionals has, perhaps, reached its highest development at Harvard and Leland Stanford Universities, where not only great latitude is allowed in the entrance conditions, but the whole college course is made up more or less fully of optional studies. That this system has been popular is shown by the more rapid growth of these and similar institutions as compared with the more conservative institutions, where many of the older classical requirements are yet rigidly insisted upon.

But, the system of optionals has gone quite far enough in some directions, not far enough in others. The average student, who has not yet made up his mind what he will do with himself, is bewildered and confused by the multiplicity of studies opened up before him. He is not competent to judge what is best for himself, and he needs at this time, more than at any other in his life, the advice and assistance of those who have gone before him over those labyrinthine roads; and he rarely gets it. The study of Chinese jurisprudence seems to have as much importance in the college curriculum as do other subjects, and, if the teacher is popular or 'easy,' he selects it. If he is working for his degree, as unfortunately most undergraduate students in the college are, he picks out the 'soft snaps' in college parlance and tries to double up on his studies that he may get through the sooner. Throughout all his preliminary course in the high school, as well as in his freshman and sophomore years, the study of language and mathematics has been strongly emphasized and he has had hardly

a glimpse of any other branch of knowledge. In the name of common sense, then, how can he be expected to have acquired any taste whatever for unrelated and dissimilar studies, or to have any conception of their relative importance? His advisers have been chiefly linguists and mathematicians, whose ignorance of the natural sciences is often equalled only by their prejudice against them. It is a fact that the larger proportion of those who have become students of the natural sciences have had their inclination formed despite of rather than by means of the university. The university seldom intimates to them that science studies ought to form an important part of their general training.

The result of all this desultory or biased study is that the student usually graduates without any clear idea of what he will do in life. He rarely studies with any definite aim, save that of getting an education, of the value of which he has little conception. He has been taught to believe that the best possible preparation for success in any department of life is a liberal education, and he does not trouble himself much as what his future career may be, resting self-satisfied in the delusive assumption that he will be fitted to enter upon anything.

It is true that the most earnest students that we have are those of the professional schools. A distinguished teacher of engineering has said: "It is unquestionably a fact that the engineering students of our colleges do more and harder work for a degree of equal grade than do the students of other departments." As a teacher of medical science I know that the average medical student does fifty per cent. more work than those of like capacities in the undergraduate arts courses. There can be no denial of the fact that the most earnest students are those who seek knowledge as a direct means of success in life rather than for the mere pleasure of its possession.

I believe, therefore, that the principle, now so largely adopted, which permits the student to browse about at his own will with a nibble here and a bite there, is wrong. He should be permitted and required early in his life to gaze upon the broad field of knowledge and at least to taste some of its enjoyments, in order that he may find out what his best and easiest path will be towards success. Away with the mediæval idea that a course in arts fits a man for anything. It does not and never will, unless it changes very much from what it yet is. As we have seen, the degree of Bachelor of Science in engineering, to which we may also add that in pharmacy, represents a larger degree of training and a greater knowledge than that possessed by the Bachelor of Arts. Why, then, does the latter assume such transcendent importance in education? Solely upon the claim of culture. How many are the sins that are committed in thy name! The classical student who has devoted five or six of the best years of his life to the study of the ancient languages, with little or no attention given to the modern sciences, is dwarfed and narrowed in his conceptions of life, even as the scientific student would be with no knowledge of the languages. Horace Greeley meant just such students as these when he said: "Of all horned cattle, deliver me from the college graduate." I by no means wish to deprecate the study of language and of philology. They are among the noblest that the student may undertake and well worthy of the ardent pursuit of the specialist. So, too, are the professions of law and medicine, but no one will presume to say that everybody should be a lawyer or a physician in order to be cultured.

At Yale College not less than nine or ten years of foreign language study are required for graduation, and not one week of any natural science. In the University of

Kansas, which may be taken as an average type of the Western universities, five years' study of foreign language must be had, and nothing whatever of any biological science.

Is that department of human knowledge which, more than all others, has been the foundation of the civilization of the present century; which has done more to lengthen life, to ameliorate its burdens, to improve, purify and advance the world; which has furnished one of the great underlying principles of modern education, of which even the philologist boasts—laboratory methods; which has established the great underlying principle of all progress—evolution; is this department of knowldge, I say, of so little importance that it is practically ignored in the requirements of a modern liberal education? Twenty-five years ago the classical course was the almost invariable one in our colleges; but even in those times I was required to learn the rudiments at least of physics, chemistry, botany, zoology and geology. Now modern education has liberalized the course by making the larger part of the language studies compulsory, and all, or nearly all, the natural sciences optional!

But the writing on the walls is so legible that he who runs may read. Yale College, the great exponent of the classical course, has been almost the only prominent college in the United States that has not gained materially in attendance during the past two years. Harvard, more liberal, does not insist upon so extended a study of the ancient languages, and will permit a considerable amount of science to be offered in their stead. Columbia College, which, until recently, has had requirements almost like those of Yale, has so modified its course that Greek is no longer demanded. To quote from its recent catalogue: "No one can obtain the degree of Bachelor of Arts who does not know something of at least one ancient language, and who has not therefore looked out through this window upon the world of antiquity. He must know also something of history, something of philosophy, something of political economy, a good deal of English, something of mathematics, and something of a least one natural science. He must also have a reading knowlege of French and German." It is refreshing to learn of one college that does require the student to leave that window of antiquity long enough to learn something of one natural science, of the laws that control the world and its inhabitants. We may be profoundly thankful that all the universities do not insist that we shall look out through two windows upon the high morality and civilization of the old Romans and Greeks.

In thus claiming some recognition for natural sciences in the course of liberal arts I shall doubtless be accused of narrowness. I trust, however, if I am, that it will not be imputed to ignorance of the classical course. I studied, when a youth, Latin and Greek for the prescribed time of six years each, and have since learned to speak or read three or four of the modern languages.

But I do more than claim recognition for the sciences. I claim broadly and emphatically that the natural sciences, any or all of them, are as valuable and as necessary as pure cultural studies as are the languages; that intelligent and successful study of them will do as much, if not more, in making the student a broad man, a successful man, as will the study of Latin or Greek. And they will do more in making him an honest man. Nowhere in all the broad field of knowledge will he learn better to think exactly than in the natural sciences. Nowhere will he be more impressed wih the importance of truth for truth's sake.

Among the graduates of the University of Kansas, with whom I am best ac-

quainted, there are not more than one-half who have had any training whatever in the natural sciences, with the exception of about ten weeks in physics and as many in chemistry, and perhaps a smattering of physiology. The simplest facts in natural history are as utterly unknown to them as is the prosody of the Hebrew language. A little, a very little, of biological science has been absorbed in the reading of fiction, of history and the newspapers.

The simplest functions of their own bodies remain for the most part sealed mysteries, the commonest laws of nature inscrutable. In fact, the ignorance of nature as a whole among the majority of the graduates of the so-called liberal colleges is usually abysmal in its profundity, stygian in its opacity. In the rules of philosophy they may be able to 'distinguish and divide a hair betwixt south and southwest side,' but are unable to tell the difference between granite and limestone, a polywog and a porpoise. In the laws of political economy they may talk learnedly and dogmatically, but are unable to locate the liver in their own body or to tell its functions. I verily believe that a third of the graduates in arts of our universities and a fourth of their instructors could not tell whether the pancreas is located above or below the diaphragm, or whether or not they have either pancreas or diaphragm at all. Grant Allen, in the *Cosmopolitan*, says: "Quite well-informed people will speak of a porpoise or a lobster as a fish; such grotesque blunders ought to be made impossible; they ought to be considered far more damnatory evidence of ignorance and ill-breeding than 'you was' or 'me and him went there.'" With such a standard how many college graduates are there who are educated?

President Dwight, in the same periodical, says: "In any future development of the college system the chief purpose of general culture should not give way or be subordinated to any purpose of special culture with a view of some special work in future years." It is this spirit of culture for culture's sake that has dominated Yale College so thoroughly in past years and which makes the institution to-day the best type of the non-utilitarian education in America. The same conservatism is evinced in Professor Peck's attitude toward education. The classical student with him is a 'gentleman and a scholar,' while the scientific student is a 'sublimated tinker.' No wonder that he urges the unwisdom of a higher education for the masses of the people.

There is much in favor of the primary importance of mind-building in education, and no education can be the best that makes it subordinate to the mere acquisition of knowledge. But the position is assumed, by those who favor the classical education, that utilitarian studies may not be at the same time cultural; that one may not get useful knowledge and mind-building at the same time.

To use President Andrews' words: "Our strictures upon classical studies in college would have less weight were it not that these subjects crowd from the curriculum numerous others which would at least be equally suitable for college drill and incomparably more valuable later. The common opinion seems to be that, to be useful in disciplining the mind, matter for study must be useless for the purposes of life. There could be no greater error. Studies like social, political, physical and biological science, and modern literature and history, all of which are vitally important for intelligent men and women who must live and act their part to-day, are precisely the ones best calculated to enlarge, cultivate and strengthen the intellect."

The mistake that President Dwight and those who think with him make is in assuming that all men are capable of the broadest and highest culture, or that a

liberal education should be limited to those only who have such capacities. We urge upon the future student of medicine that he should pursue a liberal classical course in preparation for his professional training. He replies that he has no aspirations and no ability to be a leader among men; he seeks only the best education he can get that will fit him for a more humble sphere. He skips the college course and devotes all his time to his professional studies. In fact, the strictly classical course, such as Yale best represents at the present day, is perfectly adapted for but one class of people, gentlemen of leisure, who are not dependent upon their daily toil for their bread. One would not ask the hod-carrier to pursue a course in the ancient languages before beginning his apprenticeship. Nor should one require the same of the ordinary professional student.

As an opposite extreme to the conservatism of Yale may be cited Leland Stanford University, in which knowledge of the ancient languages is not indispensable for graduation. In this institution twenty-two subjects may be offered for admission, only one of which (English) is required, the remainder to be chosen from the twenty-one other courses. This list includes algebra, geometry, trigonometry, physics, chemistry, physiology, botany, zoology, drawing, American, English and ancient history, Spanish, French, German, Latin and Greek. In the college course certain groups of studies must be selected under advice, but this is the only restriction upon free choice. The effect that this latitude has upon the choice of studies is interesting. Of those who last year took their major work in Latin and Greek there were 76; in history and economics, 219; in mathematics, 29; in the natural sciences, 223; in modern language, 80; in English, 140. In the ancient languages 151 students were enrolled the first semester of last year; in the modern languages, 686; in mathematics, 148; in the natural sciences, 926.

The friend of classical culture may justly say that the education that seems possible at Leland Stanford is a narrow and one-sided one. A student who knows nothing whatever of the foreign languages is as surely a dwarfed and one-sided man as is he who studies the languages only and none of the natural sciences. It is not to be supposed that the students of Leland Stanford are of a different class from the students of other universities. There their choice is almost wholly unrestricted and the natural inclination away from the ancient languages is conspicuously shown. The only bachelor degree given for work in any of the lines possible is that of Bachelor of Arts.

When the old classical idea was yet so firmly inwrought into higher education that all else was leather and prunella, degrees of all sorts sprung up as mushrooms—Bachelor of Science, of Philosophy, of Pedagogy, of Music, of Engineering, of Pharmacy, of Agriculture, of Mechanics, and of goodness knows what. They were frank statements that such degrees did not mean liberal culture and were given rather as placebos. These degrees have, fortunately, largely been abandoned, the older degree of Bachelor of Arts supplanting them; an acknowledgment that liberal culture may be obtained in other ways than the old classical one.

I am aware that many will lift up their hands in classical horror at the bare suggestion that such a thing is possible as a Bachelor of Arts course in science, thoroughly convinced that the wolf has at last stolen bodily the raiment of the sheep.

The effect of the present requirements for the admission to the colleges and university of Kansas has been in a high degree disastrous to science instruction in the secondary schools. Chemical laboratories

that once delighted and instructed the high school pupils, the microscope and its world of revelations, the herbarium, the museum and the dissecting knife, have been abandoned and in their place Latin, German and French have been substituted. Of all the subjects required for admission to the State University, students come best prepared in Latin, because the requirements in this subject have been made most severe and important. Instruction in the natural sciences in the secondary schools of our State is superficial and imperfect in the highest and most astounding degree. Of all those who are candidates for the State teacher's certificate to teach the sciences it is the exception that one has as much knowledge of any branch as might be acquired by the diligent student in ten weeks of work; rare that an examination paper is the equal of those offered by the second-rate students in our University.

Put, however, the same emphasis upon botany, zoology, chemistry and geology that is given to Latin and the preparation would very soon be fully as good, fully as thorough. Let the high school scholar learn that the study of the natural sciences is deemed as valuable in his preparatory training as is language or mathematics and there will be no lack of good teachers.

Were I, then, to say what the universities and colleges ought to do it would be this: Make all the ancient language requirements for admission optional, and demand as much preparation in the physical and biological sciences as in the foreign languages. The preparation in English should be made far more rigorous and thorough. In the college course, if anything besides English is required, and I think there should be, I would have the natural science as necessary a part of the education as language and mathematics. I would not have it possible for a student to graduate from the college without having studied, and thoroughly studied, mathematics as far as trigonometry, at least one foreign language, and at least one physical and one biological science. And I do not mean a few weeks of study in any of these branches, but exhaustive, careful, critical study.

The methods of study in all these branches are diverse and are absolutely essential for symmetrical mind-building.

Furthermore, an indefinite, haphazard selection of studies in the college course should be impossible. The course should be, so far as possible, adapted to the capacities, tastes and abilities of the individual, and this does not mean an indiscriminate selection on the part of the student. A person with feebly developed chest muscles might naturally prefer those physical exercises in which such muscles would take little part, but he nevertheless needs such exercise most.

It is through the great universities, and especially the State universities, that the solution of the problems of professional education must come, and in fact has come for some of the professions. With such cultural training as is best adapted to the lawyers's needs, the college course should include all the strictly non-professional branches, leaving the student, after he has completed his course as Bachelor of Arts in law, to take up the work of the professional school and complete it in two years with the degree of Doctor of Laws. In the medical course there are even greater opportunities than in law. The medical colleges should resign to the undergraduate arts course all the non-professional branches. And the work rightfully belongs there. The best chemical laboratories in the United States are not in the medical colleges, but in the universities. Nowhere are physiology, histology and anatomy better taught than outside of medical colleges. As in engineering, there should be an harmonious course leading through the high school to

the Bachelor of Arts in medicine, preparatory to two years of strictly professional work with the degree of Doctor of Medicine.

When such training as this is demanded of all aspirants to professional practice we shall have uniformly well educated men in the professions, and not until then.

S. W. Williston.

University of Kansas.

CURRENT NOTES ON PHYSIOGRAPHY.

THE REGION ABOUT LAKES TANGANYIKA AND NYASSA.

The origin by down-faulting of the linear depression holding Lake Tanganyika has been advocated by Suess in 'Das Antlitz der Erde,' and popularized by Gregory in his book on the 'Great Rift Valley.' An article by J. E. S. Moore on the Physiographical Features of the Nyasa and Tanganyika Districts (London Geogr. Journ., X., 1897, 289–300) gives additional notes of value. The south end of Tanganyika is enclosed on the west by a 2,000-foot sandstone escarpment, whence the plateau country slopes gradually westward to the shallow basin of Lake Bangweolo, whose waters are only ten or twelve feet deep; the plateau being broken by mountains of granite and gneiss which rise like islands above a sea. East of southern Tanganyika the country rises gradually; hence this part of the lake basin seems to lie in the depression between two tilted fault blocks, rather than in a *graben*. Passing southeast, the north end of Nyasa is found to lie between sandstone escarpments on either side, the enclosing uplands consisting of an uneven crystalline foundation whose depressions are occupied by sandstones and conglomerates like those around Tanganyika; this part of Nyassa is, therefore, regarded as a down-faulted rift. But going on to the south end of the lake and to its extension in Lake Shirwa, Moore finds nothing suggestive of great faults or rift valleys. Lofty granitic masses, with axes about north and south, enclose wide areas of waste slopes and alluvial flats, whose central depressions are occupied by malarial swamps and shallow lakes. The outflow by Shire river descends to lower plains through the Murchison cataracts.

It does not seem to be fully proved that the depressions between the granitic ranges were not produced by dislocations, although it is true that, in the absence of the heavy sandstones, faulting is not easily demonstrated. It may also be questioned whether the existence of the depressions 'now more or less completely filled up with decomposed granite and gneiss annually swept down into them from the hills by the prolonged tropical rain' prove that they 'have undoubtedly at one time been covered by water.' It may be added that the rains are not, properly speaking, 'tropical;' Dove having advisedly limited that term to the rains produced where the trade winds ascend mountainous slopes; the rains here are subequatorial, dependent not on the trade winds, but on the annual migration of the meteorological equator from the geographical equator.

BRÜCKNER'S ERDRINDE UND IHRE FORMEN.

The fifth edition of the standard Allgemeine Erdkunde, originally by Hann, Hochstetter and Pokorny, has for its second part a volume of 368 large pages on 'Die feste Erdrinde und ihre Formen,' by Professor E. Brückner, of Berne. It is a thorough and comprehensive work, but in its inclusion of Geology it illustrates how far Erdkunde departs from its supposed English equivalent, Geography. A quarter of the book is given to geology, including petrography, structure and stratigraphy half of the pages treat of the processes that determine surface form, and the remainder are devoted to the forms themselves. Internal processes produce volcanoes, earthquakes, shore changes and deformations.

External processes are grouped under ground water, weathering, sliding, rivers, glaciers, winds, waves and sedimentation. Forms are classified under those of the sea and of the lands; the latter being plains, escarpments, mountains, valleys, dissected regions (thallandschaften), basins, caverns, and the large forms of the land surface (mountains, plateaus, depressions). The terse style of the book shows that its author expects those who use it to be competent teachers and faithful students. Its readers may be confident of trustworthy statements and explanations; but in the third part, with which these notes are particularly concerned, there is less consideration of the genetic correlation of parts than would be welcomed by many.

THE AGE OF VALLEYS.

THE age of a valley is a measure of its stage of development. It may be steep sided and young; it may half open or mature; it may be wide open or old. At any stage in its development it may be submerged and buried, and thus preserved until some future time when it is again revealed by weathering, like any other fossil. In this sense the valley, whether young or old, may be dated as geologically ancient or modern. Thus there were mature valleys in ancient times among the St. Francis mountains of crystalline rocks in southeastern Missouri. They are still hardly more than mature, for through nearly all Paleozoic, Mesozoic and Cenozoic time they have been buried; they have only in comparatively recent time come to light again, as their relatively weak sedimentary cover has weathered off. But in another sense these mature valleys are modern, for they have been re-excavated in late post-Tertiary time. When the ancient and modern valleys coincide there may be confusion if they are briefly described as 'of very ancient origin,' and this confusion appears to enter in the paragraph given to the deep canyons of Labrador, in Adams' review of Low's report in a recent number of SCIENCE (Nov. 13, 741). The implication here, as in the original report, is that the valleys have been valleys ever since the time of their ancient origin. The probability is very great that during most of the intervening time they have been buried, and that however ancient was their initial excavation their present re-excavation is relatively modern.

W. M. DAVIS.

HARVARD UNIVERSITY.

CURRENT NOTES ON ANTHROPOLOGY.

THE QUESTION OF VARIATION.

Two recent essays on variation as applied to man may be mentioned together, although they treat the subject from different points of view. The one is by Professor Virchow, in the Proceedings of the Berlin Academy of Sciences for 1896. He describes the difference between diathesis, *Anlage* and variation, the former being the permanent, the latter the changing factor of the organism. He points out the important fact that progressive variation may arise from pathological inceptions. While his article has the greater bearing on questions of medical science, it has valuable application in anthropology.

The second article is by Professor Mahoudeau in the *Revue* of the Paris School of Anthropology for July of this year. It is taken up principally with pointing out the exact meaning of variation or transformation in organic life as laid down by Lamarck. The quotations show that he distinctly taught the descent of man from lower forms of life. In these respects he is claimed to have anticipated the most modern doctrines in his celebrated work, first published three quarters of a century ago.

THE CITY OF OMITLAN.

A YEAR or so ago the newspapers mentioned the discovery of a ruined city in western Mexico by Mr. William Nivens. Since then collections have been brought to New York City, and ample means thus furnished to judge of its characteristics. In the *Bulletin* of the American Geographical Society for July of this year, Mr. Nivens has a short article on the subject. The ruins are very extensive and indicate a skill in stone work above that of many tribes, but decidedly inferior to that of the best Aztec civilzation. His article speaks of a tablet with hieroglyphic characters, but examples of such are extremely rare, and perhaps of doubtful origin. The stones are, as a rule, not dressed with skill and the structures were not lofty. From all this we may conclude that we have in these extensive remains the relics of an inferior, subordinate culture-center of Aztec civilization; but this, of course, does not in any way diminish the interest which attaches to Mr. Nivens' explorations.

THE CAVE OF LOLTUN.

LOLTUN is the name of a remarkable cavern in Yucatan. The Peabody Museum of Archæology has just published a report of its exploration by Mr. Edward H. Thompson, in 1890–91. It is unfortunate for Mr. Thompson that the Museum waited six years to print his interesting account, as in the meanwhile another expedition, led by Mr. H. C. Mercer, of the University of Pennsylvania, carefully explored and promptly printed a full description of it in 1896. Boards of publication should be aware that the world gives credit not to him who first investigates, but to him whose investigations are first placed for use before students.

The report is well printed with attractive illustrations. The excavations were carefully made and confirm the opinion advanced by the later expedition that those who entered or dwelt in the cave belonged to the same race and people, and possessed the same culture, as those who built the great stone structures on the surface near them. Neither here nor elsewhere in the Yucatan caves did Mr. Thompson discover any signs of a distinctively 'cave people,' or of an earlier, ruder civilzation.

D. G. BRINTON.
UNIVERSITY OF PENNSYLVANIA.

NOTES ON INORGANIC CHEMISTRY.

To Berthelot's researches we owe very much of our knowledge of the chemistry and technology of the ancients. In the last *Comptes Rendus* he recounts his examination of glass mirrors found near Reims, dating from the third and fourth centuries. The glass was coated with a metal and also a whitish layer. The metal proved to be lead, with no trace of gold, silver, copper, tin, antimony or mercury, nor was there any organic substance present, showing that no extraneous material was used to cement the lead to the glass. The mirrors appeared to have been cut from hollow blown glass globes, and it is probable that, before being cut, the molten lead had been poured into the interior, adhering to the previously warmed glass. The whitish layer consisted of lead carbonate and lead oxid formed by the oxidation of the lead coating, and calcium carbonate, which had been deposited from the water of the vicinity. A similar method of coating glass with lead was known in the thirteenth century. In the same find were fragments of glass showing the lustre of gold and of silver; these metals were not present, but the color was due partly to the lamellation of the glass and partly to a very thin layer of calcium carbonate which had been deposited on them.

IN the *Chemiker Zeitung* Léon Franck describes experiments with the every-day use of spoons, forks and vessels of aluminum.

The metal was 99 per cent. pure, containing varying quantities of iron and silicon. A boiler of 732 sq. cm. surface lost in three years' daily use 0.1046 gram, a daily loss of 0.09 milligrams. Another boiler of the same size in which milk was boiled twice a day for fifteen minutes lost in three years 0.5138 gram. An impervious coating seemed to be formed on the metal which protected it from further action. This was shown by experiments with sheet aluminum, which was boiled daily three hours with water, and which suffered greater loss near the beginning of the experiment than at its close. Forks and spoons lost very little by constant use at meals, and the same was true when used for salads, and also when used in cooking. After three years' constant use coffee spoons showed a loss of from 0.032 to 0.036 grams and tea spoons from 0.0206 to 0.0244 grams. These experiments would tend to show that for ordinary table purposes aluminum is a safe metal to use, and that it is also safe for vessels for boiling water. A similar series of experiments where salted foods and vegetables were cooked in aluminum vessels would be interesting and valuable.

IN the *Zeitung für Beleuchtungswesen* Paul Wolff discusses the question of acetylene generators. Most generators depend upon the removal of the water from the calcium carbid by the pressure of the gas to stop the action of the generator. The author shows that this is not sufficient. There are three causes for the action of the water on the carbid not ceasing. 1. The gas in the carbid chamber is saturated with water vapor, and the water is continually evaporating into this chamber. 2. A part of the water is taken up by the warmed lime and given off on cooling. 3. The carbid above the water is continually absorbing water. These difficulties may be obviated to some extent by providing that the water chamber be separated as completely as possible from the carbid chamber, as in a Kipp apparatus, but even then the action will go on until all the water present, as vapor in chamber and absorbed by the lime, has been exhausted. It is thus imperative to provide a gas reservoir large enough to contain all the gas which may, under these circumstances, be evolved after the gas has been turned off. The author in the article discusses the necessary size of this reservoir for different generators.

J. L. H.

SCIENTIFIC NOTES AND NEWS.

THE will of the late Dr. George H. Horn gives his valuable entomological collections, together with his entomological books and instruments and an endowment of $200 per annum, to the American Entomological Society. From the residuary estate, after the death of his sister, the Entomological Society is to receive $5,000, the Philadelphia Academy of Natural Sciences $1,000 and the American Philosophical Society $500.

LATE advices from the Pribilof Islands state that many yearling fur seals branded as pups in 1896 made their appearance on the hauling grounds in September and October; also that over 5,000 pups and 180 adult females were branded this year. Apart from the practical bearing of this work it will furnish definite evidence of the movements of the seals and show to what extent the females resort to the rookeries on which they were born or on which they first appeared as two-year-olds.

MR. CHARLES WALLACE HUNT, New York, has been elected President of the American Society of Mechanical Engineers.

PROFESSOR JACOB REIGHARD, of the zoological department of the University of Michigan, has been appointed by Governor Pingree a State delegate to the National Fishery Congress to be held at Tampa, Fla., January 19, 1898.

FURTHER jubilee medals have been conferred upon Dr. Günther, President of the Linnean Society; on Professor Dewar, President of the Chemical Society, and on Professor R. Meldola, late President of the Entomological Society.

Professors O. Hertwig, F. E. Schultz, Berlin, and A. Fick, Wurzburg, have been elected corresponding members of the Munich Academy of Sciences.

We learn from *Nature* that Professor A. Bauer has been obliged, on account of ill-health, to decline the office of President of the third International Congress for Applied Chemistry, which is to be held next year at Vienna, and Dr. H. R. von Perger has been elected in his stead. There will be twelve sections in connection with the Congress. Among the subjects to be discussed is the introduction of uniform methods of analysis of chemical products.

Alonzo S. Kimball, since 1872 professor of physics at Worcester Polytechnic Institute, died at Worcester on December 2d, aged fifty-four years.

The death is announced of Dr. Louis Calori, elected as long ago as 1830 professor of anatomy in the University of Bologna. He made important contributions to human and comparative anatomy, including extensive researches on the Reptilia.

Dr. M. Forster Heddle, best known of British mineralogists, died at St. Andrews on November 19th, aged sixty-nine years.

We also regret to record the deaths of Dr. Wilhelm Blomstrand, professor of chemistry in the University at Lund; Dr. Nikolaus Kleinenberg, professor of comparative anatomy at the University of Palermo; Dr. Wilhelm Moericke, docent in geology in the University of Freiburg.

Mr. J. G. Sudborough, University College, Nottingham, writes to *Nature* calling a meeting of the British students of the late Victor Meyer, in order to raise a memorial to him, to be erected in the Heidelberg lecture theater. His former students in America would doubtless be glad to join in such a memorial.

The American Institute of Homeopathy has been successful in collecting funds for a monument to Hahnemann. It is said that as much as $75,000 has been collected and that the bronze statue by Mr. C. H. Niehaus will be dedicated during the spring at Washington.

The New York Board of Estimate and Apportionment adopted unanimously the plan for the New York Public Library prepared by Carrère & Hastings.

By the will of the late Warren G. Roby, of Wayland, Mass., the sum of $28,000 and half an acre of land has been left to the town of Wayland for a public library.

The National Museum of Santiago, Chili, has purchased, at a cost of about $7,000, the valuable collection of Peruvian antiquities made by Mr. Nicolaus Saenz.

The centenary of the Natural History Society of Hannover will be celebrated on December 15th and the two following days.

Nature states that M. Moureaux has just completed the installation of the new magnetic department of the Parc St. Maur Observatory, and it was set in operation on December 1st. The work at the old magnetic rooms will be continued until January 1st, in order to supply M. Moureaux with a sufficient number of observations for a reduction of the valuable records obtained continuously during a number of years.

A Pasteur Institute has been established at the University of Montpellier.

The Romanes Lecture at Oxford University next year will be given by Sir Archibald Geikie.

Dr. G. F. Jackson opened the winter course of lectures at the Imperial Institute on November 19th, the Prince of Wales presiding, with an account of the results of the Jackson-Harmsworth Expedition, on November 22d. Mr. E. S. Bruce lectured on 'Electric-Balloon Signaling applied to Scientific Exploration in Arctic and Antarctic Expeditions.' Other lectures announced for the course are illustrated lectures on 'The Wild Kafirs of the Hindu Kush,' by Sir George Scott Robertson, and on 'The Mineral Resources of British Columbia and the Yukon,' by Mr. A. J. M'Millan, of Rossland, British Columbia, formerly British agent for the government of Manitoba, who has been specially supplied with specimens, etc., to illustrate the lecture by the government of British Columbia. Professor W. C. Roberts-Austen, C.B., F.R.S., will lecture on 'Canada's Metals,' and Mr. Boverton Redwood on 'The Petroleum Sources of the British Empire.'

ARRANGEMENTS have been made for lectures by Professor Shaler and Professor James, of Harvard University, before the Teachers' College, New York.

DR. FRANZ BOAS, of Columbia University, lectured on December 3rd at the Peabody Museum, under the auspices of the Harvard Folk-Lore Club, his subject being 'The Growth of Indian Mythologies in British America.'

SURGEON-GENERAL GEORGE M. STERNBERG addressed a recent meeting of the Pittsburg Academy of Medicine on the 'Relations of man and microbe.'

DR. SVEN HEDIN, to whose travels in Central Asia we have several times referred, gave an account of these before the Royal Geographical Society, London, on November 22d.

A LETTER from Mr. Charles M. Harris, who is now at the head of the Rothschilds expedition to the Galapagos Archipelago, has been received by his brother, Dr. W. H. Harris, of Augusta, Me. Mr. Harris sailed from New York for Panama on March 20th, where he expected to charter a schooner, but three of the party there died from yellow fever. Mr. Harris then proceeded to San Francisco, where he reorganized the party and reached the islands after a passage of forty days. He states that he has been successful in making extensive collections of the fauna and flora of the islands, and expects to return to San Francisco in the spring.

THE Washington correspondent of the New York *Tribune* states that Dr. Henry S. Pritchett assumed charge of the United States Coast and Geodetic Survey on December 1st. The dispatch continues: "It will be highly gratifying to scientific circles and the friends of this Bureau to learn that the President and Secretary Gage are determined that the Bureau shall be conducted on scientific and business principles and that their plans will be carried out. Dr. Pritchett was selected entirely on the recommendations of scientific men, regardless of political views. * * * * He is a worthy successor of Dr. T. C. Mendenhall, whose admirable administration of the Bureau from 1889 to 1894 is so well remembered."

IN addition to volumes of the Contemporary Science Series (Mr. Walter Scott, London; imported by Messrs. Charles Scribner's Sons, New York) requiring special notice we have received two volumes—one a translation and one a new edition, to which attention may be called. Professor Ribot's '*Psychologie des sentiments*,' of which we gave a detailed review at the time of its publication, has been translated into English, thus much enlarging the audience of the acknowledged leader of French psychology. Dr. Moll's '*Hypnotism*' has been issued in a fourth edition, being apparently more in demand than any other volume of the series. We have not the third edition at hand for comparison, but the book has been much altered and enlarged since the publication of the first edition in 1889. The popular interest in hypnotism is in part morbid, and the numerous and widely circulated books, journals and articles on the subject do not usually add much to its scientific study, while they in some cases promote credulity and amateur experimenting. Dr. Moll's book, however, is sane and scientific, and it is to be hoped that some who come for a 'sensation' may go away with an increased knowledge of mental phenomena.

UNDER the title 'An Unusual Phyto-bezoar,' Professor Trelease has published, in the Transactions of the Academy of Science of St. Louis, an account of certain balls, composed of the felted barbed trichomes of *Opuntia*, obtained from the stomach of a Mexican bull, and comparable with similar formations described in 1896 by Dr. Coville as occurring in the stomach of a horse, and composed of the calyx hairs of a species of *Trifolium*.

THE fourth and revised edition of Professor Thurston's Engine and Boiler Trials has just been issued. In the front of the book the publishers print a descriptive list of nineteen of Dr. Thurston's works.

THE explosives department of the British Home Office has, as we learn from *Machinery*, recently had under consideration the question of the restrictions to be applied to the manufacture and keeping of acetylene gas, and has conducted various experiments with the object of gaining information on this matter. The results show conclusively that acetylene gas *per se*,

when under a pressure of something less than two atmospheres, is violently explosive; whereas, at a pressure of less than one and a half atmospheres, it appears to be reasonably free from liability to explosion, provided it is not admixed with oxygen or atmospheric air. For commercial and practical purposes it is considered sufficient to allow a pressure of twenty inches of water above that of the atmosphere (*i.e.*, roughly about one and one-twentieth atmospheres), and it is accordingly proposed to draw the safety line at this point, and to declare acetylene, when subject to a higher pressure, to be an 'explosive' within the meaning of the Explosive Act of 1875. In France and Germany the authoritities have fixed the limit of danger at one and a-half and one and one-tenth atmospheres respectively, and have imposed prohibitions or restrictions on the keeping or the manufacture of the gas when it is at a higher pressure.

Two notable articles in the *Revue de Mécanique* for October are those of Dwelshauvers-Dery on the effect of compression of steam in the 'dead spaces' of steam engines, and Sinigaglia on the employment of superheating as a source of gain in thermodynamic and actual efficiency. The former finds by trial with the 'experimental steam engines' of the University of Liège that increasing compression results in increasing waste and decreasing efficiency, the loss of power in the engine more than counterbalancing the 'initial' condensation in the steam cylinders. The latter describes in the third of a series of papers the various types of superheating apparatus employed, and gives results of their use, the gain being sometimes 20 % and more.

At the Sydney meeting of the Australasian Association for the Advancement of Science, to be held in the second week in January, Sir James Hector, F.R.S., will give a popular lecture on 'Antarctica and the Islands of the far South,' and Professor R. Threlfall and Mr. J. Pocock will give a lecture to workingmen on 'Electric Signaling without Wires.' The Sydney *Morning Herald* states that the Australasian Association originated in a letter from Professor Liversidge published in that journal in 1884. The first meeting of the Association was held in Sydney from August 27th to September 5th of the Centennial year, 1888, under the presidency of Mr. H. C. Russell, F.R.S., when 850 members were enrolled. Meetings have also been held at Melbourne, with 1,162 members, in 1890, when the late Baron von Mueller, F.R.S., was President; at Christchurch, New Zealand, with 550 members, in 1891, President Sir James Hector. F.R.S.; at Hobart, with 600 members, in 1892, President Sir Robert G. C. Hamilton; at Adelaide, with 488 members, in 1893, President Professor Ralph Tate, F.G.S.; and at Brisbane, with 524 members, in 1895, when the Hon. A. C. Gregory was President. The governments of Victoria, Tasmania, New Zealand, South Australia and Queensland have each in turn given assistance to the extent of about £1,200, either wholly or in part, as a money grant towards the expenses of the session and publication of the annual volume.

UNIVERSITY AND EDUCATIONAL NEWS.

Mr. Dean Sage and Mr. William D. Sage have given to Cornell University the house of the late Henry W. Sage for a University Infirmary. They also endow the institution with $100,000 and will equip the building for a hospital, the total value of the gift being $200,000.

The will of the late Sir Thomas Elder, of Adelaide, South Australia, leaves large sums to charitable and public institutions of Adelaide, including the following: To the Zoological Society, £2,000; to the Geographical Society, £2,000; to Way College, £2,000; to Prince Alfred College, £4,000; to the Picture Gallery, £25,000; for a chair of music at the University, £20,000; to the Medical School of the University, £20,000, and to the University £25,000.

Mr. Andrew Carnegie has given $10,000 to the endowment of the Mechanics' Institute in Richmond, Va.

The late Sir William Mackinnon has left a legacy of £2,000 to the University of Glasgow for a scholarship, in the following subjects: (1) Geology; (2) Natural History, together with Comparative Anatomy; (3) Modern Foreign Languages; the examination in each subject to be taken in each succeeding year in rotation.

KING'S COLLEGE, London, has received an anonymous gift of £25,000 towards the liquidation of its debt.

MR. JOHN P. ASHLEY, PH.D., has been elected President of Albion College, at Albion, Mich., succeeding Dr. Lewis R. Fiske, who has resigned, owing to advanced age, after twenty years of service.

DR. E. G. LANCASTER has been appointed professor of psychology and pedagogy at Colorado College.

A CHAIR of 'tropical diseases,' with Dr. J. E. Stubbert as the first incumbent, has been established in the New York University Medical College.

A COMMITTEE has been formed in London to present a plan for a London University, to be called University of Westminster, in case the bill before Parliament meets with continued opposition. The present degree-conferring University of London would according to the plan remain unchanged, while the different institutions of London would form themselves into a faculty of law, a faculty of medicine, etc., each institution to be financially independent and only to agree on the nature and duration of the studies required for degrees and distinctions.

DISCUSSION AND CORRESPONDENCE.

IN REGARD TO THE MARINE BIOLOGICAL LABORATORY AT WOODS HOLL, MASS.

TO THE EDITOR OF SCIENCE.—A full and adequate rejoinder to the statement which appeared in SCIENCE October 8, 1897, has been prepared and is now ready. In our opinion, however, controversial matters relating to the management of a scientific institution, especially when consisting of details, statistics or mooted points, are out of place in public prints. The subject is not of general interest, and discussion of this kind tends to injure any institution in the public estimation.

The undersigned, therefore, prefer to reply only to those concerned in the matter. To this end we shall issue to all members of the corporation and others concerned a detailed reply to the charges brought by the former Trustees. Others who may feel interested can obtain copies by applying to the Secretary of the Trustees of the Marine Biological Laboratory, Woods Holl, Mass., or to either of the undersigned.

SAMUEL F. CLARKE,
EDW. G. GARDINER,
J. PLAYFAIR MCMURRICH.

SCIENTIFIC LITERATURE.

Anthropologische Studien ueber die Ureinwohner Brasiliens. Von DR. PAUL EHRENREICH. Braunschweig, Vieweg und Sohn. 1897. 4to. Pp. 168. 30 Plates.

This work ranks among the most valuable which have appeared for years in American Anthropology. It is, to be sure, somewhat limited in its area of observation, being principally confined to the states of Matto Grosso, Goyaz and Amazonas in Brazil; but this is more than compensated by the abundance and accuracy of the material, and the skill with which the author has brought it into bearing on the leading general questions relating to the American race.

These are treated in the general portion of the volume, occupying forty-five pages. It embraces two chapters, one on the aims and methods of physical anthropology and its bearings on ethnology; the other specifically on the anthropologic position of the American race. Much of the former is concerned with defining such terms as race, type, people, stem, family, etc.; with the conclusion that race means blood relationship, and that the racial characteristics and variations are the only real objects of study in physical anthropology. The author is here on thin ice, and his definitions, carefully trimmed as they are, can often be punctured. Blood relationship, *Blutverwandtschaft*, really means nothing, for, in one sense, the whole human species is related by blood; and as much might be said of other terms assumed to have a generally recognized sense. This merely shows how needful it is to settle on an international terminology in anthropology.

The chapter on the Amercan race is more satisfactory. He regards it as strictly one, in the Blumenbachian sense. As for the question, Whence it came? He regards it superfluous to inquire, as it has certainly been on the continent from remotest human antiquity, probably

under widely different geological relations, and before language had developed. He considers the following three propositions 'established beyond question:' 1. Man is as old in America as in Europe. 2. The oldest American skulls present the same type as those of the modern Indians. 3. Between the languages of America and Asia there is a gulf which cannot be bridged. (P. 42.)

The special portion of the book is divided into two parts, the one supplying the measurements on the living subjects, the other those on skulls and skeletons. Numerous illustrations from photographs, detailed tables and outlines of skull-forms greatly aid the student in obtaining clear ideas of the physical characters of the tribes mentioned. They include the Caribs, Bakairi, Tupis, Botocudos, Chaco tribes, and those of the valley of the Purus River.

The general conclusion which he draws from these extensive comparisons will be surprising to many, especially those who have said so much about the 'Mongoloid' traits of the American Indians. "So far as their physical traits are concerned, these Indians of ours approach much more closely the types of the Caucasian than of the Mongolian race. The arms and generally the upper extremities, the elevation of the symphysis and the navel, are thoroughly European." (P. 130.)

The osteological material was mainly from the Bororo, Karaya and Kayapo tribes. It is figured fully and the measurements presented in detail. Some of the skulls were of low capacity and their nannocephalic character suggests the already known relations of the people of the Purus, among whom they prominently occur, to the Arawacks of the northern shores of the continent, and to the island-dwellers of the West Indian archipelago.

The general impression left after an examinations of the craniological measurements, however, is one of wide diversity, a diversity not satisfactorily explained by the author's various suggestions of amalgamation and environment, but from its sporadic abundance, going back to sources of variation in skull-proportions which diminish their value as race criteria.

The work is furnished with a table of contents, an index of authors quoted, and one of subjects; a completeness of reference which it is a pleasure to note. D. G. Brinton.

The present volume is of great importance, not only on account of the detailed information given in the special part of the work, but also on account of a critical examination of the methods of somatology. The following lines are intended as a review of this general part of the work.

Dr. Ehrenreich is one of the few anthropologists who have an equal command of somatological, ethnological and linguistic methods. His criticism of modern somatology is directed mainly against the excessive weight given to measurements as compared to morphological description and to the loose use of the terms race and type.

He would reserve the term 'race' for the principal divisions of mankind, while he would call the varieties of these main divisions 'types.' He objects strongly to the application of the term 'race' to closely affiliated varieties which differ in regard to a few measurements, while their fundamental morphological features are much alike. He justly attributes much of the confusion prevailing in anthropological literature to a lack of clear distinction between the main groups and their subdivisions, and particularly to the tendency which has developed of recent years to consider a few anthropometrical criteria as a sufficient basis for the establishment of a new race.

In determining the 'races,' or the main divisions of mankind, Ehrenreich demands the consideration of three principal phenomena. He claims that each race is characterized by similarity of anatomical traits, geographical continuity of habitat, and similarity of the structure of the languages spoken by the people constituting the race. The first two points are well taken. They refer, of course, to conditions prevailing before the modern migrations of races. I doubt, however, if it is admissible to introduce the last point of view in the definition of the principal divisions of mankind. Ehrenreich is led to include languages in the characterization of races by three considerations. He says: (1) Every race has developed a greater or lesser number of characteristic linguistic stocks. (2) These stocks are not found outside

the limits of each race, excepting a few instances which are explained by certain peculiar conditions. (3) There are fundamental differences between the structures of the languages spoken by the different races, and no connecting links between them exist. Based on these arguments he distinguishes six races, leaving the position of the Papuas and of the black peoples of Asia doubtful. I will not lay great stress upon the fact that these principles of classification lose their applicability among the last-named people, as in their case peculiar conditions prevail. But there are other cases which show that these principles do not help us to establish a definite number of races. The linguistic considerations would make it impossible to include the pre-Aryan peoples of Europe and western Asia, in what Ehrenreich terms the Caucasian or Mediterranean race, although the anatomical characteristics of these peoples are identical with those of the Mediterranean race. On the other hand, the American race shows considerable anatomical uniformity as compared to other races, and, nevertheless, there is no unity of structure of language in Ehrenreich's sense of the word. It is no less possible to imagine a connecting link between the principles of structure of the Algonquin and Eskimo than between the Eskimo and Ural-Altaic languages. If we are willing to consider American languages as a unit, and include only these principles in the general characterization of American languages that hold good in all of them, there is nothing to prevent us from including Ural-Altaic languages in the same group. Ehrenreich agrees in these opinions with the views expressed by Brinton in his discussion of the characteristics of American Languages. (Essays of an Americanist, p. 350 ff.)

Dr. Ehrenreich's second criticism of modern anthropology is directed against the excessive weight given to measurements as compared to morphological descriptions. He expresses the opinion that the classification according to cephalic indices which has held sway since the days of Retzius has greatly hampered the development of somatology and has made efforts at classification futile, since these were based on measurements, particularly on indices, alone, while they must be based on morphological descriptions. These latter, he holds, cannot be replaced by numerical values. While heartily agreeing with this view, particularly with the objection to the exaggerated value given to the length-breadth index of the head, I do not think that Dr. Ehrenreich's condemnation of anthropometry is quite justified. He defines the object of somatology as the somatic investigation, description, and if possible explanation of racial characteristics. With this, I believe, all anthropologists will agree. The only question is what methods are best adapted to these ends. A broad view of the history of anthropology shows that measurements were originally introduced in order to give precision to certain descriptive features which could not be expressed satisfactorily in words. This appears to have been the leading view of Daubenton and Camper, who were the first to introduce measurements in discussions referring to comparative anatomy. The nearer alike the types which we compare, the more difficult it is to describe in words their nice distinctions. Anthropology was the first branch of descriptive biology to deal with closely allied varieties, and for this reason the need of substituting exact numerical values for vague descriptions was soonest felt. Since zoology, more particularly the study of mammals and of birds, has begun to take into consideration the geographical races of the same species we observe the same tendency of adding measurements to verbal descriptions.

In so far as Dr. Ehrenreich's criticism is directed against the substitution of measurements for descriptions that they should supplement, it is most timely and ought to be taken to heart by investigators. The terms dolichocephalic and brachycephalic as indicating two groups of head forms determined by measurements have by some investigators been raised almost to the rank of specific characters, although, as Ehrenreich justly emphasizes, and in this he has the support of Sergi, Harrison Allen and others, the sameness of the index does not by any means signify sameness of morphological type. He disclaims the significance of these characters when not supported by general morphological agreement. In all this the author is certainly right. But he overlooks entirely the principal and fundamental value of numerical measures

as illustrating the range of variability of types which cannot be given by any verbal descriptions. The type inhabiting a certain region cannot be defined satisfactorily by a substitution of descriptive features selected by even the closest observation. It is not possible, as Ehrenreich says, to represent a type by a typical individual. The description must include all the individuals in order to illustrate the composition of the group that is being studied. In order to give an adequate description it is necessary to illustrate the frequency of different types composing the group. While the types found in two adjoining areas may be almost identical their distribution may differ. The attempts to treat the same subject by means of composite photographs or composite drawings, which form a purely theoretical point seem very promising, offer serious practical difficulties which make it difficult to use these methods. The variability of a type can, therefore, be expressed only by means of carefully selected measurements. Dr. Ehrenreich states with great clearness that none of the proposed series of measurements are satisfactory, but we must add that a way exists of discovering such measurements. This way is shown in Professor Karl Pearson's admirable investigation on correlations which was suggested by Galton's important work on heredity. By its means laws of correlation may be discovered which express morphological laws. It seems to me, therefore, that the author's condemnation of anthropometrical methods for determining geographical varieties is too sweeping.

The scepticism with which the author regards the results of anthropometry lead him also to the conclusion that sameness of type is not a sufficient proof of common descent; that the latter is only proved if supported by historical and linguistic evidence. This opinion is open to serious objections. It is certainly true that it is impossible to determine by anatomical characteristics alone to what people a single individual belongs. But it is perfectly feasible to identify a series of individuals belonging to a certain people or district, if the series is sufficiently large. Dr. Ehrenreich, it would seem, has been misled by the fact that all types are variable and cannot be represented by a single typical individual to consider the whole task a hopeless one. Even though it is not possible to establish for a people a single anatomical type to which all individuals conform and which is characteristic of that people and no other, this does not prove that we cannot trace its genesis by means of a study of the various types constituting the people and their distribution among the people itself and its neighbors. The author acknowledges this fact to a certain extent when saying: "Whoever tries to rely in these investigations on physical characters alone will certainly be led astray. A consideration of the geographical point of view and of historical evidence will give much greater certainty to his conclusions." Here, as in the discussion of the races of man, the author strongly emphasizes the geographical point of view, and in this he agrees with F. Ratzel. He urges the necessity of considering the geographical probability of blood-relationship before generalizing from anatomical similarities. The considerations of this point of view, on which the reviewer has also repeatedly insisted, will certainly prevent anthropologists from forming rash conclusions and propounding extravagant theories.

But I do not believe that the introduction of linguistic considerations in the somatological problem will be found to be of advantage. It is true that wherever we find two tribes speaking affiliated languages there must have existed blood-relationship; but we have abundant proof showing that by infusion of foreign blood the anatomical types have changed to such an extent that the original type has been practically swamped by the intruders. Such is the case in North America among the Athapaskan tribes of the Southwest, among the widely scattered Shoshonean tribes, and in many other cases. The laws according to which anatomical types are preserved are not the same as those according to which languages are preserved, and for this reason we must not expect to find the results of classifications based on these two considerations to coincide. Dr. Ehrenreich seems to think that types are too variable to give any satisfactory basis for deductions of this character. But, notwithstanding the fact that certain anatomical features are easily

affected by the influence of environment, I cannot acknowledge that any proof of the transformation of the fundamental features of types exists.

In our investigations on the early history of mankind three methods are available, each directed to a certain series of phenomena—physical type, language, customs. These are not transmitted and do not develop in the same manner. The one persists when the other changes, but all may be made to contribute to the solution of the general problem. The study of the distribution of languages permits us to make nicer divisions and to follow historical changes in greater detail than that of the distribution of physical types. But often the latter give evidence in regard to phenomena which cannot be approached by linguistic methods. The distribution of the Alpine type of man in Europe, or that of the Sonoran type in North America, may be mentioned as instances of this kind. It would be absurd to state that in these cases similarity of type does not prove blood-relationship, because there is no linguistic evidence to support it. On the contrary, the physical investigation supplies evidence that cannot be gained by linguistic facts. The three methods mentioned above are all equally valuable, but since they do not refer to the same classes of facts it must not be expected that they will clear up the same incidents in the early history of mankind, but all may be utilized with equal advantage in the study of this subject.

In regard to the affinities of the American race to other races Dr. Ehrenreich seems to be inclined to consider it as equally closely related to the Asiatic and to the European races. He lays particular stress upon the proportions of the body and the form of the hair as distinguishing the Americans from the Asiatics. In this opinion he agrees to a certain extent with Brinton. It would seem to me that in determining the position of a race we should be guided by the morphology of its most generalized forms, namely of women and children. The far-reaching similarity between American and Asiatic children and women is very striking. They have in common the wide and rather low nose, the form of the eye and of the maxilla. The physiognomic similarity is so great that it would seem to be of greater weight than the variable proportions of the body which are much more subject to influences of environment.

FRANZ BOAS.

The Alternating-Current Circuit: An Introductory and Non-mathematical Book for Beginners and Students. By W. PERREN MAYCOCK. London, Whittaker & Co. 1897. 16mo. Pp. 97. Price, $1.00.

It is the author's purpose to convey some idea of single-phase alternating currents to the minds of those new to the subject, by means of plainly worded and non-mathematical language. In his preface (April, 1897) he states that the book forms the substance of a chapter in the forthcoming Volume II. of 'Electrical Lighting and Power Distribution.' With a thorough revision it would make an admirable chapter for such a book. Although the book is small, the reviewer appreciates the amount of labor that has been spent upon it in arranging the more important alternating current phenomena and discussing them in a manner suitable for non-mathematical beginners. The author has attempted to make his style simple and clear, successfully in the main, but with many startling lapses. What idea is conveyed to a reader (and he need not be a non-mathematical beginner) from the statement (p. 8), "The current in a given circuit is thus proportional to the distance traversed at each alternation by any given coulomb, *C*, multiplied by the number of alternations per second; so that if the current is kept constant, when the frequency is doubled, the path traversed by any given coulomb will be halved, and *vice versa*."

We note error as well as confusion; for example, on page 64 we are told that reactance varies directly as the inductance and the mutual induction. As a matter of fact, mutual induction in a case of a transformer diminishes the reactance; for the primary circuit of a transformer has less reactance when the secondary is loaded than when it is on open circuit. Again, it is stated (pages 64 and 85) that reactance depends directly upon the inductance and the *frequency*, and inversely upon the capacity. This is true when the current lags behind the

electromotive force, but when the circuit is in advance of the electromotive force an increase of frequency decreases the reactance.

The author points out that the terms virtual and effective are employed indiscriminately by some writers, but has been unsuccessful in his attempt to make the terms clear. The effective value of the E. M. F. is taken to be its component of direction of the current; the effective current is the component of current in the direction of the E. M. F., all of which is quite beyond criticism, unless it be one of words. 'Virtual value' is adopted to designate the square root of the mean square value and is properly explained to be the equivalent of a direct electromotive force or current which would produce the same effect either on an electrostatic voltmeter, or in heating. Thus, we may have occasion to refer to the virtual value or to the maximum value of any quantity, as of the impressed E. M. F., of the effective E. M. F., of the total current, or of the effective current. Although thus clearly giving a proper meaning to the term virtual, the author usually employs 'virtual E. M. F.' as synonymous with 'impressed E. M. F.,' and 'virtual current' as being the total or actual current which flows as distinguished from a particular component of it. Thus (p. 83), "In most circuits the impressed or virtual E. M. F. meets with an opposing E. M. F. of reactance, and the effective E. M. F. is something less than the virtual E. M. F. * * *" Also (p. 84), "That proportion of the current which can do useful work may be called the *effective current*. When there is no phase difference, the effective current is the same as the virtual current; but as the angle of lag or lead increases, so does the value of the effective as compared with the virtual current diminish." Again (p. 87), the author refers to 'impressed or virtual electromotive force.'

These two much abused words are likewise unnecessarily dragged in; thus (p. 64) we note 'virtual or effective resistance;' (pp. 89 and 93), effective watts,' the imputation being that we, might likewise have ineffective watts! Also (p. 94) we are told that the virtual watts put into a circuit may be far in excess of the actual power conveyed!

Throughout the book the author has used terms with meanings other than those he has assigned to them by definition.

These blemishes are serious ones. With thorough revision, the book will satisfactorily meet the admirable end the author had in view.

FREDERICK BEDELL.

Anleitung zur Mikrochemischen Analyse der wichtigsten organischen Verbindungen. Von H. BEHRENS, Professor an der Polytechnischen Schule zu Delft. Viertes Heft. Karbamide und Karbonsaeuren. Mit 94 Figuren im Text. Hamburg und Leipzig, Verlag von Leopold Voss. 1897. Pp 129. Mark 4.50.

In the first number of Professor Behrens' book the anthracene group, phenols, quinones, ketones and aldehydes were considered. The second number, treating of fibrous materials, was reviewed in this JOURNAL for January 15, 1897. The third number deals with aromatic amines, and with the present number continues the work satisfactorily. It should be remembered that Professor Behrens' work is the only textbook extant in this important field.

E. R.

Die Chemie im täglichen Leben. Von DR. LASSAR-COHN. Universitäts Professor zu Königsberg. Zweite Auflage. Hamburg und Leipzig, Verlag von Leopold Voss. 1897.

The first German edition of Professor Lassar-Cohn's book was fully reviewed in this JOURNAL for January 22, 1897, by Professor Orndorff. The appearance of a second German edition, and the success of Professor Pattison-Muir's English translation show the value of the book.

E. R.

SOCIETIES AND ACADEMIES.

THE NEBRASKA ACADEMY OF SCIENCES.

THE eighth annual meeting of the Academy was held at Lincoln on November 26th and 27th. On the first day the Presidential address was given by Dr. A. S. von Mansfelde, of Ashland, his subject being 'Some Practical Applications of Science.' It was devoted largely to a discussion of the alcohol question from the scientific and medical point of view in opposition to many untenable positions taken by advocates of total abstinence.

The paper by Dr. H. B. Ward on 'Factors in Civilized Life which modify the Abundance of Parasitic Animals' in man and domestic animals dealt with the advantage of modern methods of stall-feeding, watering from wells, cleanly modes of killing and packing. Dr. E. H. Barbour reported progress on the study of Dictomaceous Earths in Nebraska. Lymnæa, Physa and Planorbis occur as fossils. The beds are furnishing excellent material for packing engine boilers as a non-conductor of heat. 'The Flora of a Dried-up Mill Pond,' by C. J. Elmore, included a list of species and a classification of them according to habit and mode of distribution. Most of the species did not occur on the adjacent bank.

Dr. C. E. Bessey presented evidence of poisoning by *Rhus radicans* without direct contact and concludes that Dr. Pfaff's non-volatile toxicodendrol may not be the only poisonous principle present or that it must be sufficiently volatile to escape in hot moist air. Dr. Roscoe Pound presented observations on the 'Abundance of Certain Secondary Species in Prairie Formations,' and showed how it may be determined quantitatively by definite count, and how misleading any other estimate is apt to be. Professor F. W. Card presented 'Notes on Root Growth,' showing that whether roots were cut back much in planting or not the new roots in any case arose mainly from the base of the roots rather than from the callus at their tips, so that best results were obtained by leaving the roots without cutting back.

Mr. H. M. Benedict discussed the generic characters of the genus *Ichthyotænia* and described a new species. Professor G. D. Swezey reported upon experiments with color screens in astronomical photography, by which an ordinary visually corrected objective gave good results in photographing bright objects.

The evening was devoted to a lecture by Mr. N. H. Darton, of the U. S. Geological Survey, on 'Some Points in the Geology of Nebraska,' with lantern illustrations, and to a banquet for members and their wives.

The first paper on November 27th, by Dr. E. W. Davis, was a discussion of certain mathematical relations between the surfaces, edges and vertices of regular solids. Miss Carrie Barbour reported upon the history and results of the Morrill Geological Expeditions. Dr. E. H. Barbour reported upon 'A Second Nebraska Meteorite,' weighing six pounds; also upon 'Our Beds of Volcanic Ash,' which are found widely distributed in the State and which furnish a very pure polishing powder. They are found distinctly stratified and fossiliferous, showing aqueous deposition.

A paper by Dr. E. W. Davis on 'Karl Pearson's Researches on the Mathematical Theory of Evolution' showed how the theory of probabilities may be used in the discussion of biological and similar data. Mr. W. D. Hunter reported upon 'Additions to Professor Bruner's List of Nebraska Birds' and upon progress in compiling lists of insects of various orders for the State. Dr. Roscoe Pound reported upon the 'Progress of the Botanical Survey of Nebraska,' particularly upon the beginnings of a study of the phytogeographic as distinguished from the mere floral aspects of the subject. Dr. R. H. Wolcott presented a paper 'On the Genus *Atax*,' giving an account of generic characters, habits and a number of new species.

For lack of time the following papers were read by title only:

The Fern Allies of Franklin county, Neb.: E. M. Hussong.

The Peat Beds and Underlying Diatomaceous Deposits along Cedar Creek and Tributaries: J. P. Rowe.

On the Experimental Proof of Faraday's Theory of Electricity: Louis T. More.

Announcement of New Nebraska Fossils: Dr. E. H. Barbour.

Observations on the Concretions of the Pierre Shale: Carrie A. Barbour.

On the Taxonomy of the Nemathelminthes: Dr. H. B. Ward.

Oolitic Sands from the Dakota Cretaceous of Nebraska: Dr. E. H. Barbour.

Some Points in the Geology of Lincoln and its Environs: C. E. Fisher.

The following officers for the ensuing year were elected:

President, Dr. H. B. Ward, Lincoln; Vice-President, Dr. A. S. von Mansfelde, Ashland; Secretary-Treasurer, Professor G. D. Swezey, Lincoln; Custodian, Professor Lawrence Bruner, Lincoln.

The meeting was the most successful one in the history of the Academy, both in attendance and in the interest manifested. Its annual volume of Proceedings is now in press, and will be larger and more fully illustrated than usual.

G. D. Swezey,
Secretary.

BIOLOGICAL SOCIETY OF WASHINGTON—282ND MEETING, SATURDAY, NOVEMBER 20.

Mr. David White exhibited two specimens of Carboniferous shale from Lerkis-Bey, near Amasra, Asia Minor, on which are associated *Neuropteris Scheuchzeri* Hoffm., and *N. fimbriata* L., together with fragments of another *Neuropteris*, possibly *N. ovata* Hoffm., and two species of *Pecopteris*, one of which was *P. abbreviata* Brogn. Especial attention was called to the interesting circumstances that not only do these species appear to be identical in details with specimens similarly identified in the collection of the U. S. National Museum from the Lower Productive Coal Measures of Ohio and Pennsylvania, but that in this continent the species are also found in immediate association.

Dr. Erwin F. Smith exhibited a simple style of hypodermic syringe recently brought out by Baurch and Lamb.

Dr. Sternberg stated that it was identical in principle with one devised by himself when at Johns Hopkins University.

Professor O. F. Cook described 'A New Wingless Fly from Liberia,' stating that it was perhaps referable to the family Phoridæ, but that it represented a new genus to which the name *Wandolleckia* was given in honor of Dr. B. Wandolleck, Dipterist of the Berlin Museum. Wings, balancers and ocelli are lacking; the eyes are reduced to about forty hemispherical facets and the abdomen is membranous, the chitinous plates being rudimentary. The type *Wandolleckia achatinæ* inhabits the deep forests of Liberia, where it is found actively running about on *Achatina variegata* Roissy, the largest West African land snail. The genus may be related to *Puliciophora* Dahl, a wingless form from the Bismarck Archipelago, but is generically distinct in the much greater reduction of the abdominal plates and in the armature of the tarsi. The resemblance of both forms to fleas is probably merely superficial and has no phylogenetic implication.

Mr. V. K. Chestnut presented a paper entitled 'Some Recent Cases of Mushroom Poisoning.' The symptoms of ten cases collected by the Botany Division of the U. S. Department of Agriculture during the past year were given. Two of these were fatal to four individuals. The minor cases were caused by *Clitocybe illudens*, *Russula emetica*, *Boletus subtomentosus*, *Agaricus morganii*, a species of *Clavaria*, and the puff ball, *Lycoperdon giganteum* Batsch. One case of poisoning by the last-named species was especially noted because, although the fungus was unquestionably fresh and was properly cooked, the symptoms were very marked. The two fatal cases reported were caused by the fly amanita (*Amanita muscaria* (*L.*) *Fr.*) and the death cup (*Amanita phalloides* (L.)Fr.). It was conclusively shown by photographs, drawings and specimens that the former caused the death of Count de Vecchj in Washington on November 10, 1897, it having been mistaken for the orange amanita (*Amanita cæsarea*). The case was, however, complicated with apoplexy. Another gentleman who ate some of the same fungus was saved by repeated doses of $\frac{1}{100}$–$\frac{1}{50}$ of a grain of atropine, this being an almost perfect physiological antidote to the effects of muscarine. The seeds of Jimson weed (*Datura strammonium*) could also be used to advantage in such cases. Freshly ignited charcoal is valuable for its physical properties in absorbing the poison, and an alkaline solution of the permanganate of potash is in some cases useful as a chemical antidote. There is no antidote against the effects of phallin, the toxalbumin which causes death in *Amanita phalloides* poisoning, but in severe cases the transfusion of salt water or fresh blood is recommended. The action of the poison from the two amanitas is altogether different. Muscarine paralyzes the heart and produces marked stupor, while phallin dissolves the red blood corpuscles, causes a gradual collapse and generally leaves the brain unaffected.

Dr. Erwin F. Smith spoke on Bacterial Diseases of Plants, taking for his text certain misstatements in Dr. Alfred Fischer's recent *Vorlesungen über Bakterien.* At least ten diseases of plants are now known to be due to

bacteria. These are about equally divided between Europe and America, and there is no excuse for ignorance concerning them.

F. A. LUCAS, *Secretary.*

ZOOLOGICAL CLUB, UNIVERSITY OF CHICAGO.
OCTOBER, 1897.

Two Cases of Mimicry.—The results of some observations on the mimetic habits of the Syrphid flies of the genus *Spilomyia* were presented. *S. fusca*, Leow, which is dull black-banded and spotted with yellowish white, was frequently seen flying about in the shrubbery and feeding on the honey of some golden-rods that had sprung up in a clearing in the pine woods (Price Co., Wis.). This Syrphid resembles in size, form, coloration and movements *Vespa maculata* and a smaller allied species of wasp, and was observed to occur in the same places and at the same time as these Hymenopterous models. A large female of *S. fusca* was masticated and found to have an agreeable flavor, the alimentary tract of the insect being full of honey in this instance. Therefore, warning colors are associated with the absence of disagreeable smell and taste, as the generally accepted theory of mimicry requires. In the same locality *Spilomyia quadrifasciata*, Say, was less common than *S. fusca*. It strikingly resembles the species of *Odynerus* (*O flavipes* and *O. foraminatus*), which also frequent the flowers of the golden-rods. Both insects are black, spotted and banded with bright yellow, the black predominating. The genus *Spilomyia* includes also a third group of mimics, which, like *S. liturata*, Williston, closely resemble the 'yellow-jacket' wasps (*V. germanica*, etc.). In these flies the deep yellow bands are broader and more numerous and the black coloring more restricted than in *S. fusca* and *S. quadrifasciata*.

W. M. WHEELER.

Secondary Mesoblast in the Mollusca.—Secondary mesoblast was first found in the mollusks in the lamellibranch Unio by Dr. F. R. Lillie. This secondary mesoblast was found to arise asymmetrically from a cell of the second generation of ectomeres on the left side of the egg. It subsequently becomes disposed symmetrically on both sides of the egg, apparently by a migration of some of the cells, and is mainly employed in the formation of the larval adductor muscle.

Later, secondary mesoblast was discovered in the gasteropod crepidula by Dr. Conklin. It was found to arise from the second generation of ectomeres, as in Unio, but from three quadrants instead of one, and at a much later stage of develepment than in the form studied by Lillie.

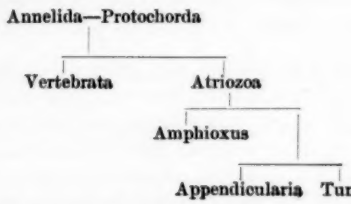
The secondary mesoblast in Physa, according to Wierzejski, and in Planorbis, according to my own observations, has a still different origin, since it arises from cells of the third generation of ectomeres on the anterior side of the egg. Its origin is symmetrical, as it arises from the two anterior quadrants of the third quartette, which lie on either side of the median plane. The divisions of the cells in the third quartette in Planorbis agree very closely with those of Physa until a late period of cleavage. In both forms the first division of the cells of the third quartette is radial; at the next division both the upper and lower cells in the two anterior quadrants divide horizontally into equal parts. The next cleavage in the anterior quadrants is the unequal division of the lower pair of cells, each cell giving off a small cell toward the vegetal pole. In both Physa and Planorbis the upper pair of cells resulting from this last cleavage contain the secondary mesoblast. In Planorbis these cells, after dividing almost horizontally, sink into the segmentation cavity and finally lose connection with the wall of the blastula. Whether these cells are entirely converted into secondary mesoblast in Physa, as in Planorbis, appears uncertain from Wierzejski's account. S. J. HOLMES.

Dr. Whitman gave an account of his observations concerning the results of crossing the brown and the white varieties of ring-dove, and Dr. Watase read a paper entitled 'Protoplasmic Contractility and Phosphorescence.'

During the month the following reviews of recent papers were also given: 'The Embryology of Crepidula' (Conklin), A. L. Treadwell; 'Recent Literature on Spermatogenesis' (Meves and Hermann), W. H. Packard; 'Structure of Nermertean Nerve-cells' (Montgomery), G. W. Hunter.

SCIENTIFIC JOURNALS.

The American Naturalist, November.—'Cephalic Homologies. A contribution to the determination of the ancestry of vertebrates,' CHARLES SEDGWICK MINOT; Advocates the following phylogeny:



'The Limits of Organic Selection,' HENRY FAIRFIELD OSBORN: Opening a discussion at Detroit already reported in SCIENCE. 'The Geological Congress in Russia,' CHARLES PALACHE. 'Some Unwritten History of the Naples Zoological Station:' An account of an address given by Dr. Anton Dohrn, at Woods Holl, on October 10th. 'Wind River and Bridger Beds in the Huerfano Lake Basin,' HENRY FAIRFIELD OSBORN. 'Peculiar Zonal Formations of the Great Plains,' FREDERIC E. CLEMENTS. 'The Cricket as a Thermometer,' A. E. DOLBEAR.

The Astrophysical Journal, November.—'The Importance of Astrophysical Research and the Relation of Astrophysics to other Physical Sciences,' JAMES E. KEELER. 'Aspects of American Astronomy,' SIMON NEWCOMB. 'The Aim of the Yerkes Observatory,' GEORGE E. HALE: Three addresses given on the occasion of the dedication of Yerkes Observatory. 'Spectroscopic Notes,' SIR WILLIAM and LADY HUGGINS: Discusses the spectra of the stars in the trapezium of the Great Nebula of Orion, the spectra of the colored components of β Cygni, the ultra violet spectra of α Lyræ and of Arcturus and on the effect of density on the spectrum of calcium. 'New Investigations of the Spectrum of β Lyræ,' A. BÉLOPOLSKY. 'On the Constitution of the Red Spectrum of Argon,' J. R. RYDBERG. 'Spectra of Bright Southern Stars,' EDWARD C. PICKERING.

The American Journal of Science, December.—'A Microsclerometer, for determining the Hardness of Minerals,' T. A. JAGGAR, JR.: Descriptions with illustration of the author's instrument. 'Recent Observations on European Dinosaurs,' O. C. MARSH: Communication made to the National Academy of Sciences, noticed in the last issue of this JOURNAL. 'Sapphires from Montana, with special reference to those from Yogo Gulch in Fergus county,' G. F. KUNZ. 'Corundum-bearing Rock from Yogo Gulch, Montana,' L. V. PIRSSON. 'Crystallography of the Montana Sapphires,' J. H. PRATT: These three papers discuss the sapphires from Montana and their petrological and crystallographic aspects. 'Electrical Measurement by Alternating Currents,' H. A. ROWLAND: Describes numerous new methods for measuring capacities, inductances and resistances. 'The Alleged Jurassic of Texas. A Reply to Professor Jules Marcou,' R. T. HILL.

NEW BOOKS.

La culture des mers en Europe. GEORGES ROCHÉ. Paris, Félix Alcan. 1898. Pp. 328. 6 fr.

Physical Problems and their Solutions. A. BOURGOUGNON. New York, D. Van Nostrand. 1897. Pp. iv+222.

La face de la terre. ED. SUESS. Translated into French by EMMANUEL DE MARGERIE and MARCEL BERTRAND. Paris, Armand Colin et Cie. Pp. 835. 5 fr.

The Strength of Materials. MANSFIELD MERRIMAN. New York, John Wiley & Sons. 1897. Pp. 124.

Report of the Commissioner of Education for the year 1895–6. Vol. 2. Washington, Government Printing Office. 1897. Pp. vii+2173.

Scientific Aspects of Christian Evidences. G. FREDERICK WRIGHT. New York, D. Appleton & Co. 1898. Pp. vii+362. $1.50.

Erratum: In the article on 'Primitive Man in the Delaware Valley' by Professor W. H. Holmes, in the last issue of SCIENCE, pages 827–8, the two cuts were placed over the wrong titles and should be transferred.